

**TRANSMISSION SYSTEM MODERNIZATION AND STRENGTHENING
PROJECT IN HYDERABAD METROPOLITAN AREA**

UNDER JICA FUNDING

SPECIFICATION NO: e-LIPT-15/2012/JB JICA Lot I &II 3-3

FOR



**SUPPLY, ERECTION & COMMISSIONING OF UNDER GROUND OPTICAL FIBRE
CABLE, OPGW & OLTE ALONG WITH ASSOCIATED EQUIPMENT FOR
PROVIDING COMMUNICATION TO 220kV & 132kVSSs IN HYDERABAD
METROPOLITAN AREA UNDER JICA FUNDING**

OPEN COMPETITIVE BIDDING

**TRANSMISSION CORPORATION OF ANDHRA PRADESH LIMITED
HYDERABAD - 82
INDIA**

CHIEF ENGINEER/LIFT IRRIGATION
VIDYUT SOUDHA, HYDERABAD- 500082
PHONE NO: 91-40-23317632
PABX: 91-40-23396000
EXTN: 3583//3537/3323
FAX: 91-40-23317632

Spec. No. e-LIPT-15/2012 /JB JICA Lot I &II 3-3

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SECTION - I
NOTICE INVITING BIDS

SECTION-I
NOTICE INVITING BID (NIT)

SPEC. NO. e-LIPT-15/2012/JB JICA Lot I &II 3-3

1. The Government of India (herein after referred to as borrower) and APTRANSCO (herein after referred to as executing agency) has received on ODA Loan from JICA JAPAN INTERNATIONAL COOPERTION AGENCY (formerly JBIC), for Transmission system modernisation and strengthening project in Hyderabad, vide loan no. ID-P 178 dt. 26-3-2007 and intends to apply a portion of the proceeds of the loan to payments under the contract for supply, erection supervision, testing and commissioning of 132kV, 33kV gas insulated metal enclosed switchgear including providing communication equipment. Disbursement of an ODA Loan by JICA will be subject, in all respects, to the terms and conditions of the loan agreement, including the disbursement procedures and the "Guidelines for procurement under JICA ODA loans. "No party other than Government of India and APTRANSCO shall derive any rights from the loan agreement or have any claim to loan proceeds.

The above loan agreement will cover only a part of the project cost and for the remaining portion, through PFC funding.

2. The APTRANSCO invites sealed bids from eligible bidders for supply, erection & commissioning of under ground optical fibre cable, OPGW & OLTE along with associated equipment for providing communication to 220kv & 132kv SSs in Hyderabad metropolitan area under JICA funding in a single Lot against specification no. e-LIPT-15/2012/JB JICA Lot I & II 3-3 as indicated in this section

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| 1. | DEPARTMENT NAME | TRANSMISSION CORPORATION OF ANDHRA PRADESH LIMITED |
| 2. | Circle/ division name | CHIEF ENGINEER / LIFT IRRIGATION |
| 3. | Spec. No. | e-LIPT-15/2012/JB JICA LOT I &II 3-3 |
| 4. | Bid subject | Supply, erection & commissioning of under ground optical Fibre cable, OPGW & OLTE along with associated equipment for providing communication to 220kv & 132kv SSs in Hyderabad metropolitan area under JICA funding |
| 5. | Estimated contract value | Rs. 834.296 lakhs |
| 6. | Period of contract | -NA- |

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| 7. | Form of contract | Single package |
| 8. | Bid type | Open and two part bidding |
| 9. | Bid category | Supply, erection & commissioning of equipment |
| 10. | Bid security | Rs. 16.7 Lakhs |
| 11. | Bid security payable to | Pay officer, transmission corporation of Andhra Pradesh limited, Vidyut Soudha, Hyderabad - 500 082, payable at Hyderabad in case of DD or chief engineer /lift irrigation in case of bank guarantee. |
| 12. | Process fee | NA |
| 13. | Schedule available date & time | 7.00pm on 29-5-2012 |
| 14. | Schedule closing date &time | 03.00 pm on 28-6-2012 |
| 15. | Bid submission closing date & time | 05.00 pm on 28-6-2012 |
| 16. | Bid submission | Online |
| 17. | P.Q / Technical bid opening date (qualification and eligibility stage) | 03.00 pm on 29-6-2012 |
| 18. | Price bid opening date & time | Not applicable |
| 19. | Eligibility criteria | <p><u>A) physical experience:</u></p> <p>The bidder must have successfully supplied and executed on turnkey basis at least 40% of the tendered quantity of the OPGW & Under ground Unarmoured 48F DWSM type optical fibre cable, OLTEs & Digital Protection couplers of same or higher class indicated in the "schedule of requirement" in one continuous period of 12 months and the offered make of equipment of the package shall also be erected & commissioned and in successful operation for atleast two years as on the date of bid opening. Its financial turnover during any one year of the last five years should have been equal or more than 100% value of the package now quoted.</p> <p>At least 20% of quantity of OPGW & Under ground Unarmoured 48F DWSM type optical fibre cable, OLTEs &</p> |

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| | | <p>Digital Protection couplers of similar material/higher grade OPGW & U/G 48F OFC and other offered equipment supplied & commissioned should be in successful operation since 2 years as on the date of opening of the bid</p> <p>B) financial turnover:-</p> <ol style="list-style-type: none">1. Financial turnover during any one year of the last five years should have been equal or more than the estimated cost value of quoted items.2. Reports on financial standing of the bidder such as profit and loss statement, balance sheets and auditor's report for the past five years, in support of financial turnover and banker's certificates regarding bank limits. <p>Responsibility for correctness of the information submitted in online bid lies with bidder. If any information furnished in the bid is proved to be false at a later date, the bid will not only be rejected but the bidder will be blacklisted.</p> |
| 20. | Place of bid opening | In the chambers of chief engineer / lift irrigation, room no. 445/A block/ Vidyut Soudha. |
| 21. | Officer inviting bids | Chief Engineer /Lift Irrigation /APTRANSCO |
| 22. | Address | Room no. 445, A-Block, Vidyut Soudha, Khairatabad, Hyderabad-500082 |
| 23. | Contact details | Phone : 040-23396000 extn. 3583, 3537/3323 Fax : 040-23317632 |
| 24. | Procedure for bid submission | <p>Procedure for submission of bids:-</p> <p>(A) The bids should be in the prescribed form, which can be obtained from 'e' procurement platform from the date of electronic publication up to the time and date indicated in the bid notice. The intending bidders would be required to enroll themselves on the 'e' procurement market-place www.eprocurement.gov.in. Those contractors who register themselves in the 'e' procurement market place can download the bid schedules free of cost. The bidder shall authenticate the bid with his digital certificate for submitting the bid electronically on e-procurement platform and the bids not authenticated by digital certificate of the bidder will not be accepted on the e-procurement platform following the g.o.ms.no.6, I.T&C department, dated. 28-2-2005.</p> <p>(B) Intending bidders can contact office of the Chief Engineer /Lift Irrigation / APTRANSCO for any clarification / information on any working day during</p> |

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| | <p>working hours.</p> <p>(C) The bidders who are desirous of participating in “e” procurement shall submit their technical bids, price bids etc., in the standard formats prescribed in the bid documents, displayed at “e” market place. The bidders should invariably upload the statement showing the list of documents etc., in the “e” market place in support of their technical bids. The bidder should upload scanned copies of all relevant certificates. The bidder shall sign on all the statements, documents, certificates, uploaded by him, owning responsibility for their correctness / authenticity.</p> <p>(D) Technical bid evaluation of the bidders would be done on the certificates/documents uploaded towards qualification criteria furnished by them.</p> <p>(E) Following the G.O.Ms. No. 174/ dt.1-9-2008, the successful bidder shall invariably furnish the following securities / payments before entering into agreement either personally or through courier or by post and the receipt of the same with in the stipulated time shall be responsibility of the bidder. Department will not take any responsibility for any delay or non-receipt.</p> <p class="list-item-l1">(I) The original bid security either DD / BG.</p> <p class="list-item-l1">(II) The bidder shall furnish original of all documents / certificates / statements uploaded by him</p> <p class="list-item-l1">(III) The bidder shall furnish their company broachers, technical write-ups and printed materials if any.</p> <p class="list-item-l1">(IV) They shall not furnish the bid prices hard copy. Price bid shall be only on e-platform.</p> <p>(f) If any successful bidder fails to submit the original hard copies of uploaded certificates/ documents, DD/BG towards EMD with in the stipulated time. If any variation is noticed between the uploaded documents and the hard copies submitted by the bidder, the successful bidder will be suspended from participating in the tenders on e-procurement platform for a period of 3 years. The e-procurement system would deactivate the user id of such defaulting successful bidder based on the trigger/ recommendation by the tender inviting authority in the system. Besides this, the department shall invoke all processes of law including criminal prosecution of such defaulting bidder as an act of extreme deterrence to avoid</p> |
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| | | <p>delays in the tender process for execution of the development schemes taken up by the government. The information to this extent may be displayed in the e-procurement platform website.</p> <p>The bidder shall furnish the declaration that:</p> <ol style="list-style-type: none">1). They have not been black listed in any department in A.P. due to any reasons.2). They have not been demoted to lower category in any department in A.P. for not filing the bids after buying the bid schedules in a whole year and their registration have not been cancelled for a similar default in two consecutive years.3). They will agree to get disqualified themselves for any wrong declaration in respect of the above and get their bid summarily rejected.4). The soft copies uploaded by them are genuine. Any incorrectness / deviation noticed will be viewed seriously and apart from canceling the work duly forfeiting the bid security, criminal action will be initiated including suspension of business and/ or black listing. |
| 6 | General terms & conditions. | <p>BID NOTIFICATION – APTRANSCO BID NOTICE NO. e- LIPT-15/2012/JB JICA Lot I &II 3-3</p> |
| | | 1) bids are invited on the e-procurement plat form for the above-mentioned procurement from the firms eligible |
| | | 2)Bid security. To be paid in the shape of crossed demand draft drawn on any scheduled /nationalized bank drawn in favour of the pay officer, transmission corporation of Andhra Pradesh limited, Vidyut Soudha, Hyderabad - 500 082, payable at Hyderabad or bank guarantee, issued from any nationalized/scheduled bank to be valid for a period of 60 days over and above the validity of bid i.e. 90 days from the date of bid opening (for a total period of 150 days from the date of bid opening). Scanned copy of D.D. Or B.G towards bid security may be uploaded with the bids |
| | | 3) Bid schedules: Bid schedule can be downloaded free of cost from the web site www.eprocurement.gov.in |

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| | | 4) the bidder is subject to be disqualified, if he is found to have mislead or furnished false information in the forms / statements / certificates submitted in proof of qualification requirements and record of performance such as abandoning of work, not properly completed in earlier contracts, inordinate delays in completion of works, litigation history and or financial failures and or participated in the previous bidding for the same work and has quoted unreasonable high price |
| | | 5) Even while execution of the contract, if found that the bidder had produced false/fake certificates of experience, he will be black listed and the contract will be terminated and his bid security will be forfeited and <u>contract will be carried through other agency at his cost and risk.</u> |
| | | 6) A)transaction fee: the participating bidders have to pay transaction fee of 0.03% on estimated contract value with a cap of rs 10000/- for all tenders with ECV upto 50 crores plus service charges @ 12.36%, and Rs.25000/- (rupees twenty five thousand only) with service charges @ 10.3% for contract with ECV above rs.50.00 crores through online payment gateway with any master/visa credit card issued by any bank and through net banking facility (direct debit) with UTI, ICICI or HDFC banks. |
| | | b) corpus fund :- the successful bidder shall pay an amount equivalent to 0.04% of ECV (estimated contract value) with a cap of Rs. 10,000 (rupees ten thousand only) for all contracts with ECV upto rs.50 crores and rs.25000/- (rupees twenty five thousand only) for contracts with ECV above rs.50.00 crores on e-procurement platform before entering into agreement/issue of purchase orders, towards e-procurement fund in favour of Managing Director, APTS, Hyderabad through the agreement authority |
| | | 7) Income tax certificate: furnishing of income tax certificate is dispensed with; however the contractor shall furnish their copy of permanent account number (pan) card and copy of latest income tax returns submitted along with the proof of receipt. |
| | | 8) Insurance: the insurance policy is to be taken in favour of employer i.e., department by the agency at the time of concluding the agreement. It should form part of agreement. No. Agreement will be concluded with out insurance policy |

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| | | 9) The bidder should furnish the proof of registration under value added TAX / CST, along with tax payers identification number (tin) from the commercial tax department. |
| | | 10) In case of discrepancy with bid conditions in the bid document and nit, the condition in the bid document prevails. |
| | | 11) NOTE: A) Any other condition regarding receipt of bids in conventional method appearing in the bid documents may please be treated as not applicable. B) the contractors are to upload the information in zip format preferably. C) The successful bidder is requested to submit the original DDs. D) The contractors should upload the documents duly signing each and every paper. |

SECTION-II

INSTRUCTIONS TO BIDDERS

SECTION-II
INSTRUCTIONS TO BIDDERS

Name of Procurement: ---- Supply, erection & commissioning of under ground optical Fibre cable, OPGW & OLTE along with associated equipment for providing communication to 220kv & 132kv SSs in Hyderabad metropolitan area under JICA funding

Phase-I

1. 220kVSS Malkaram-220kV Ss Gunrock
2. 220kVSS Chandrayanagutta - 220kVSS Imlibun
3. 132kVSS Osmania Univiersity – 132kVSS CHilakalaguda
4. 132kVSS Erragadda – 132kVSS Balkampet
5. 132kVSS Balkampet – 132kVSS Patigudda
6. 132kVSS Patigudda - 132kVSS Hussain Sagar

Phase-II

7. 220 kVSS Hayatnagat-400/220kVSS Ghanapur
8. 132kVSS Patigadda – 220kVSS Gunrock
9. 220kV/132kV SS Imlibun – PTO (Miralam Filter bed)
10. LILO Overhead line of Ghanapur –Imibun to Moosarambagh GIS
11. 132kVSS Narayanaguda-132kVSS Fever Hospital
12. 132kVSS Fever Hospital – 132kVSS Osmania Hospital

The Chief Engineer / Lift Irrigation / APTRANSCO invites bids for the above materials during the period, for which dates and time specified in the nit and will be opened by (him) or his nominee at his office on the date and time mentioned in the nit.

- 1.1 The intending Bidders would be required to enroll themselves on the ‘e’-procurement market place at www.eprocurement.gov.in
- 1.2 The Bids should be in the prescribed form invited on e-procurement by the Chief Engineer / Lift Irrigation / AP Transco/Vidyut Soudha/Hyderabad (As specified in NIT) that can be downloaded free of cost from the website www.eprocurement.gov.in
- 1.3 The dates stipulated in the Bid notice are firm and under any circumstances they will not be relaxed unless officially extended.
- 1.4 The Bidder should upload scanned copies as specified in checklist and all enclosures required for the schedules and Appendices and the successful bidder shall produce copies (Bid security, & Transaction Fee) before the placing of the purchase order. Bidders should produce the originals of all documents for verification if asked for by the Competent Authority within 3 (Three) days.
- 1.5 The Bid opening Authority will not consider any Bid received after expiry of date and time fixed (As specified in NIT) for receipt of Bids on-line.
2. **Transaction Fee:** The Transaction Fee at 0.03% on ECV (Estimate Contract Value) Of Contract With A Cap Of Rs 10000/- For All Procurements With ECV Up To Rs 50

Cr And Rs 25000/- For procurements with ECV Above Rs 50 Cr, And 12.36 % On Transaction Fees As Service Tax, At The Time Of Bid Submission Through Online Payment Gateway With Any Master/Visa Credit Card Issued By Any Bank And Through NET BANKING FACILITY (DIRECT DEBIT) WITH UTI, ICICI OR HDFC BANKS. .

- 2.1 The successful bidder shall pay an amount equivalent to 0.04% of ECV (estimated contract value) with a cap of Rs. 10,000 (Rupees ten thousand only) for all contracts with ECV upto Rs.50 Crores and Rs.25000/- (Rupees Twenty Five thousand only) for contracts with ECV above Rs.50.00 crores on e-Procurement platform before entering into agreement/issue of purchase orders, towards e-Procurement fund in favour of Managing Director, APTS, Hyderabad through the Agreement authority. Bidders shall obtain digital certificates from APTS at a one time cost of Rs.1,200/-.
- 2.2 The successful Bidder is expected to complete the work within the time period specified in the NIT.

3. Bidders / Firms eligible to Bid:

- 2.0 The Bidders / Firms who
- i) Possess the valid registration as mentioned in the NIT and satisfies all the conditions therein.
 - ii) Are not blacklisted or debarred or suspended by the Government for what ever the reason, prohibiting them not to continue in the contracting business
 - iii) Have complied with the eligibility criteria specified in the NIT are the eligible Bidders /Firms.

2.1 Bidders / Firms ineligible to Bid:

- (i) A retired officer of the Govt. of AP or Govt. of India executing works is disqualified from Biding for a period of two years from the date of retirement without the prior permission of the Government.
- (ii) The Bidder who has employed any retired officer as mentioned above shall be considered as an ineligible Bidder.
- (iii) The contractor himself or any of his employee is found to be Gazetted Officer who retired from Government Service and had not obtained permission from the Government for accepting the contractor's employment within a period of 2 years from the date of his retirement.
- (iv) The Contractor or any of his employees is found at any time after award of contract, to be such a person who had not obtained the permission of the Government as aforesaid before submission of the Bid or engagement in the Contractor's service.
- v) Contractor shall not be eligible to Bid for works in AP Transco where any of his near relatives are employed in the rank of Assistant Engineer or Assistant Executive Engineers and above on the Engineering side and Assistant Accounts Officer and above on the accounts side. The Contractor shall intimate the names of persons who are working with him in any capacity or are subsequently employed. He shall also furnish a list of Gazetted /Non-Gazetted State Government Employees related to him. Failure to furnish such information, Bidder is liable to be removed from the list of approved

contractors and his contract is liable for cancellation.

Note: Near relatives include

Sons, step sons, daughters, and step-daughters.
Son-in-law, and daughter-in-law.
Brother-in-law, and sister-in-law.
Brothers and Sisters.
Father and Mother.
Wife / Husband.
Father-in-law and Mother-in-law
Nephews, nieces, uncles and aunts
Cousins and
Any person residing with or dependent on the contractor.

3.0 Qualification requirements of the Bidders:

- 3.1 The Bidder shall furnish the following particulars in the formats provided online and supported documentary evidence shall be uploaded as required at Section V.

Attested copies of documents relating to the registration of the firm, partnership deed, articles of association, commercial tax registration, latest income tax clearance certificate /latest it return and pan number from IT department etc.. Copies of the purchase orders and performance certificates in proof of supply and execution of OPGW & Under ground unarmoured 48F Optical Fibre cable.

- 3.2 Even though the bidders meet the above qualification requirements, they are liable to be disqualified / debarred / suspended / blacklisted if they have

- 3.2.1 Furnished false / fabricated particulars in the forms, statements and / annexure submitted in proof of the qualification requirements and/or

- 3.2.2 Not turned up for entering into agreement, when called upon with in the time specified in the letter of acceptance

- 3.2.3 Record of poor progress such as abandoning the work, not properly completing the contract, inordinate delays in completion, litigation history or financial failures etc. and/or

- 3.2.4 A history of criminal record in which the bidder is involved if any.

- 3.2.5 History of litigation with govt. during the last 5 years in which the bidder is involved.

3.5 ELIGIBILITY CRITERIA:

A) PHYSICAL EXPERIENCE:

The bidder must have successfully supplied and executed on turnkey basis at least 40% of the tendered quantity of the OPGW, Under ground 48F unarmoured Optical Fibre Cable, OLTE & digital protection couplers of same or higher class indicated in the "Schedule of Requirement" in one continuous period of 12 months and its

financial turnover during any one year of the last five years should have been equal or more than 100% value of the package now quoted. The offered make of the equipment of the package shall also be erected & commissioned and in successful operation for at least two years as on the date of bid opening.

At least 20% of the quantity of similar material/higher grade OPGW, Under ground 48F unarmoured Optical Fibre Cable, OLTE & digital protection couplers and other offered equipment against this Specification should be in successful operation since 2 years, within 5 years as on the date of opening of the Bid.

B) FINANCIAL TURNOVER:

1. Financial turnover during any one year of the last five years should have been equal or more than the estimated value of the package. reports on financial standing of the bidder such as profit and loss statement, balance sheets and auditor's report for the past five years, in support of financial turnover and banker's certificates regarding bank limits.

RESPONSIBILITY OF CORRECTNESS OF THE INFORMATION SUBMITTED IN ONLINE BID LIES WITH BIDDER. IF ANY INFORMATION FURNISHED IN THE BID IS PROVED TO BE FALSE AT A LATER DATE, THE BID WILL NOT ONLY BE REJECTED BUT THE BIDDER WILL BE BLACKLISTED.

THE BIDS NOT COMPLYING WITH THE STIPULATED COMPLETION PERIOD WILL BE TREATED AS NON-RESPONSIVE.

While being equal or compatible in other aspects preference will be given to those bidders who have experience in erection of above works similar to that given in the specification or of higher voltages during the last five financial years.

If a bidder quoting for the bids is having poor performance in the and not commensurate with the agreement in the previous contracts, the bid of such bidder will not be considered for award of contract.

3.6.1 One Bid per Bidder:

Each bidder shall submit only one bid. A bidder who submits more than one bid will cause dis-qualification of all the bids submitted by the bidder.

4.0 COST OF BIDDING :

- 4.1 The bidders shall bear all costs associated with the preparation and submission of its bid, and Chief Engineer /Lift Irrigation/ APTransco, Vidyutsoudha, Hyderabad-82 referred to as "the purchaser" will in no case be responsible or liable for those costs, regardless of the contract or outcome of the bidding process.

COST OF THE BID DOCUMENT : NIL FOR E-PROCUREMENT

SECTION – III

GENERAL TERMS AND CONDITIONS OF CONTRACT

SECTION -III

GENERAL TERMS AND CONDITIONS OF CONTRACT

A. INTRODUCTION.

1.0 DEFINITIONS

1.1. In this contract, the following terms will be interpreted as indicated:

- A) "The contract" means the agreement entered into between the purchaser and the supplier, as recorded in the contract form signed by the parties, including all attachments and appendices thereto and all documents incorporated by reference therein.
- B) "The contract price" means the price payable to the supplier under the contract for the full and proper performance of its contractual obligations.
- C) "The materials / equipment" means all of the equipment, machinery, and/or other materials which the supplier is required to supply to the purchaser under the contract.
- D) "The services" means those services ancillary to the supply of the materials/equipment, such as transportation and insurance, and any other incidental services, such as installation, commissioning, provision of technical assistance, training, and other such obligations of the supplier covered under the contract.
- E) "GCC" means the general terms and conditions of contract contained in the section.
- F) "The purchaser" means the organization purchasing the materials/equipment.
- G) Vendor is a supplier who has registered with the purchaser for supply of materials / equipment.
- H) "The supplier" means the firm supplying the materials / equipment and services under this contract.
- I) "day" means calendar day.

2 APPLICABILITY:

2.1. These General Conditions of contract will apply to the extent that they are not superseded by provisions of salient features of the bid.

3 STANDARDS

3.1 The materials / equipment supplied under this contract will conform to the standards mentioned in the technical specifications, and when no applicable standard is mentioned, the authoritative standards appropriate to the 'materials/equipment' i.e., BIS, such standards will be the latest. all materials will be of best class and will be capable of satisfactory operation under tropical conditions without distortion or deterioration.

3.2 INTERCHANGEABILITY:

All similar materials and removable parts of similar equipment will be interchangeable with each other. A specific confirmation of this should be furnished in the bid.

4. SCOPE OF WORK:

This specification covers design manufacture, testing and delivery FADS (free at destination stores) of the materials described at section iv and technical specification section v for supply, erection & commissioning of under ground unarmoured optical fibre cable, OPGW & OLTE along with associated equipment for providing communication to 220kv & 132kv SSs in Hyderabad metropolitan area under JICA funding on the following Tx lines

Phase-I

13. 220kVSS Malkaram-220kV Ss Gunrock
14. 220kVSS Chandrayanagutta - 220kVSS Imlibun
15. 132kVSS Osmania Univiversity – 132kVSS CHilakalaguda
16. 132kVSS Erragadda – 132kVSS Balkampet
17. 132kVSS Balkampet – 132kVSS Patigudda
18. 132kVSS Patigudda - 132kVSS Hussain Sagar

Phase-II

19. 220 kVSS Hayatnagat-400/220kVSS Ghanapur
20. 132kVSS Patigadda – 220kVSS Gunrock
21. 220kV/132kV SS Imlibun – PTO (Miralam Filter bed)
22. LILO Overhead line of Ghanapur –Imibun to Moosarambagh GIS
23. 132kVSS Narayanaguda-132kVSS Fever Hospital
24. 132kVSS Fever Hospital – 132kVSS Osmania Hospital

5. ELIGIBLE BIDDERS:

Bidders who meet the pre-qualification requirements as on the date of tender opening described at Section-VI only need quote. Bids received from firms/agent/authorized representative not meeting the above criteria will not be considered.

B. THE BIDDING DOCUMENTS

6. CONTENTS OF BIDDING DOCUMENT:

6.1. The materials / equipment required, bidding procedures, and contract terms are prescribed in the bidding documents as listed below:

1. Notice inviting bid
2. Instructions to bidders & checklist
3. General terms and conditions of contract
4. Schedule of requirements (delivery schedule)
5. Qualification requirements.
6. Sample forms
7. Technical specifications

6.2. The Bidder is expected to examine all instructions, forms, terms and Technical specifications in the bidding documents. Failure to furnish all information required by the bidding documents or to submit a bid not responsive to the bidding documents

in every respect will be at Bidder's risk and may result in the rejection of its bid.

7. CLARIFICATION OF BIDDING DOCUMENTS:

- 7.1. **CLARIFICATION OF BIDDING DOCUMENT:** A prospective bidder requiring any clarification of the bidding documents may notify the purchaser in writing or by cable (hereinafter, the terms cable is deemed to include telex and facsimile) at the purchaser's address. The purchaser will respond in writing to any request for clarification of the bidding documents, which it receives no later than fifteen (15) days prior to the deadline for the submission of bids. written copies of purchaser's response (including an explanation of the query but without identifying the source of inquiry) will be put on website of the purchaser or intimated by mail. the proposals seeking clarifications will not be entertained after the prescribed period.

8. AMENDMENT TO BIDDING DOCUMENTS:

- 8.1 At any time prior to the deadline for submission of bids, the purchaser, for any reason, whether at its own initiative or in response to a clarification requested by a prospective bidder, may modify the bidding documents by amendment.
- 8.2. All such amendments also would be made available on the www.eprocurement.gov.in and also **website of aptransco** and such amendments will be binding on the respective bidders.
- 8.3. In order to allow prospective bidders reasonable time in which to take the amendment into account in preparing their bids, the purchaser, at its discretion, may extend the deadline for the submission of bids.

C. PREPARATION OF BIDS

9 LANGUAGE OF BID:

The bid prepared by the Bidder including all correspondence and documents relating to the bid exchanged by the Bidder and the Purchaser, will be in English.

10 Cost Associated with Bidding:

The Bidder will bear all costs associated with the preparation and submission of its bid, and the Purchaser, will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

- bidders have to pay a transaction fee @ 0.03% of ECV (estimated contract value) with a cap of Rs 10000/- for all works/supplies with ECV up to Rs 50 cr and Rs 25000/- for works/supplies with ECV above Rs 50 cr, at the time of bid submission electronically.
- transaction fee & other charges to C-1 INDIA & APTS shall be paid by either credit card or debit card.
- bidders have to pay 'service tax' as levied by Government of India on transaction fee, electronic payment gateway charges.
- successful bidders shall pay another 0.04% of ECV to APTS towards e-procurement fund.

Bidders shall obtain digital certificates from APTS at a one time cost of Rs 1,200/-

11 DOCUMENTS CONSTITUTING THE BID:

11.1 The bid prepared by the bidder will comprise the following components:

- I. The bid comprises the bid document and price bid (Schedule-A), available online at www.eprocurement.gov.in and Qualification information and supporting documents (to be uploaded by the Bidder)
- II. Documentary evidence establishing in accordance with clause no.19 that the bidder is eligible to bid and is qualified to perform the contract if its bid is accepted.
- III. Documentary evidence establishing that the materials / equipment and ancillary services to be supplied by the bidder are as per the technical specification of the bidding documents; and
- IV. Bid security in accordance with clause no.20.
- V. Taxes and duties clearance certificates
- VI. Schedule of Deviations
 - (i). Commercial
 - (ii). Technical

All the schedules will be duly filled online with full details as called for, in the schedules required for evaluation of bids. Bidders are required to duly fill in all the schedules and sample forms and enclosed (upload) them to the bid.

12. COMMERCIAL FORM:-

The bidder shall complete the commercial form appropriately. **Bidder shall quote unit ex works prices for all the items under mechanical accessories in commercial form. basic price per unit in the commercial form shall be the total ex works price of all items except erection and commissioning multiplied by the respective quantity. Where as the total ex works cost of erection and commissioning items shall be indicated against erection & commissioning column in the commercial evaluation form.**

13. BID PRICES:

- 13.1. The prices quoted will be firm and in Indian rupees only. Bids will be called for with prices FADS inclusive of packing and forwarding E.D. & S.T. and other legally permissible duties and levies wherever applicable, handling charges to cover the transport by road from destination railway station to site / stores, unloading at destination and insurance (transit and storage at site for 45 days).
- 13.2. Even though composite price is given the break-up for all the duties, taxes, freight, insurance, packing and forwarding etc., will be furnished.

It is the responsibility of the bidder to inform himself of the correct rates of duties and taxes leviable on the materials at the time of bidding.

The Proforma Credit Available To The Bidder On the Purchases Of Inputs (Raw Materials) consequent to the introduction of “MODVAT” scheme may be taken into account while quoting the prices.

14. VARIABLE PRICES & PRICE VARIATION BASIS:- Not applicable

15. TAXES AND DUTIES

- 15.1. A bidder will be entirely responsible for quoting the correct taxes and duties, other local taxes or levies if any, license fees, etc., he has to incur until completion of the contract.
- 15.2. If the rates of statutory levies assumed by the bidder are less than the actual rates prevailing at the time of bidding, the purchaser will not be responsible for such errors. If the rates of statutory levies assumed by the bidder are later proved to be higher than the actual / correct rates prevailing at the time of bidding, the difference will be passed on to the credit of the purchaser.
- 15.3. Deemed Export Benefits:- This is not applicable for local purchases with APTransco funds.

16. STATUTORY VARIATIONS:

Any variation up or down in statutory levy or new levies introduced after signing of the contract under this specification will be to the account of APTRANSCO provided that in cases where delivery schedule is not adhered to by the supplier and there are upward variation / revision after the agreed delivered date the supplier will bear the impact of such levies and if there is downward variation / revision the APTRANCO will be given credit to that extent.

17. Bid Currencies:

Prices will be quoted in Indian Rupees, and will be paid in Indian Rupees Only.

18. Quantity to quote:

Bidder shall quote for **full quantities** of all items specified in Schedule Of Requirement in Section IV on "single responsibility basis". Offers without following this procedure are liable for rejection.

19. Documents Establishing Bidder's Eligibility and Qualifications:

The Bidder will furnish as part of its bid, documents establishing the bidder's eligibility to bid and its qualification to perform the contract if its bid is accepted.

The documentary evidence of the bidder's qualifications to perform the contract if its bid is accepted will establish to the purchaser's satisfaction.

- a) That the bidder has the financial, technical and production capability necessary to perform the contract.
- b) That the bidder meets the qualification criteria listed in section VI in addition the bidder may furnish full particulars regarding supply of the material in question made so far to APTRANSCO during the last five years and other reputed utilities

- 19.1 Documents establishing materials / equipment conformity to bidding documents. The bidder will furnish and upload as part of its bid ,documents establishing conformity to the bidding documents of all Materials / equipment and services, which the Bidder proposes to supply under the Contract.

The documentary evidence of conformity of the Materials / equipment and the services to bidding documents may be in the form of literature, drawings, and data, and will consist of:

- a) A detailed description of the essential technical and performance characteristics of the Materials / equipment;
- b) The bidder should specifically mention about furnishing the test certificates and a specimen form of test certificate should be furnished along with the bid.
- c) A list giving full particulars, including available sources and current prices of spare parts, special tools etc., necessary for the proper and continuing functioning of the Materials / equipment following commencement of the use of the Materials / equipment by the Purchaser; and
- d) An item-by-item commentary on the Purchaser's Technical Specifications demonstrating substantial responsive-ness of the Materials / equipment and services to those specifications, or a statement of deviations and exceptions to the provisions of the Technical Specifications.

For purposes of the commentary to be furnished pursuant to above, the Bidder will note that standards for workmanship, materials, and equipment, as well as references to brand names or catalogue numbers designated by the Purchaser in its Technical specifications, are intended to be descriptive only and not restrictive. The Bidder may substitute alternative standards, brand names, and / or catalogue numbers in its bid, provided that it demonstrates the Purchaser's satisfaction that the substitutions ensure substantial equivalence to those designated in the Technical Specifications.

20 Bid Security

- 20.1 The Bidder will upload, as part of its bid, a Bid Security for an amount as indicated in Schedule of requirements of Section IV & Section-I(NIT) of bid document. The amount should be paid by way of a crossed demand draft drawn on any schedule bank in favour of the Pay Officer, APTRANSCO and payable at headquarters of the Purchaser. The crossed DD should invariably be uploaded along with the bids. Alternatively the bidders may furnish a B.G. in original in lieu of DD as per the proforma attached. Fax / photocopies of the bid security will not be accepted and will be rejected.
- 20.2 The fact of having uploaded bid security by DD/B.G along with the bid shall be clearly indicated.
- 20.3 Submission of BID SECURITY by way of Cheque, Cash, money order, call deposit will not be accepted and will be considered as disqualification.
- 20.4 Requests for exemption from payment of bid security will not be entertained in any other cases.
- 20.5 Any bid not secured as above will be rejected by the Purchaser.
- 20.6 The successful Bidder's Bid Security in original shall be furnished before placing of order and the same will be discharged after the award of contract and acceptance of performance security.
- 20.7 The Bid Security may be forfeited:
 - a) if a Bidder:
 - i Withdraws its bid or alters its prices during the period of bid validity specified by the

- Bidder on the Bid Form, or
- ii. Does not accept the correction of errors pursuant to Clause No. 30.2; or
 - iii. Offers post Bid rebates, revisions or deviations in quoted prices and / or conditions or any such offers which will give a benefit to the Bidder over others will not only be rejected outright but the original Bid it self will get disqualified on this account and the Bidder's BID SECURITY will be forfeited.
- b) In the case of a successful Bidder, if the Bidder fails:
- i To sign the contract in accordance with Clause No. 38.
 - ii To furnish performance security in accordance with Clause No.39.
- 20.8 In case where the Bidder claims of having furnished Bid Security by way of DD/BG but if the same is not received, such Bids will be rejected and bidder will run the risk of being banned.
- 21. Period of validity of bids.**
- 21.1. Bids will remain valid for the period of ninety (90) days from the date of bid opening prescribed by the Purchaser. A bid valid for a shorter period will be rejected.
- 21.2. In exceptional circumstances, the Purchaser may solicit the Bidder's consent to an extension of the period of validity. The request and the responses there to will be made in writing (or by cable). The Bid Security provided under Clause No. 18 will also be suitably extended. A Bidder may refuse the request without forfeiting its Bid Security
- 22. Tax clearance certificates:**
- Copies of Income Tax, Sales Tax and Turnover Tax certificates for the latest period from the appropriate authority will invariably be submitted. In the case of proprietary or partnership firm it will be necessary to produce the certificate / certificates for the proprietor or proprietors and for each of the partners as the case may be. If the Bidder has already produced the certificate during the calendar year in which the bid is made, it will be sufficient, if particulars are given.
- 23. Service Conditions**
- 23.1. The equipment / materials offered will be entirely satisfactory for operation under the climatic conditions indicated below:
- a) Maximum ambient air temperature (in shade) 45 deg.C
 - b) Maximum ambient air temperature (under sun) 50 deg.C
 - c) Maximum daily average ambient air temperature 35 deg.C
 - d) Maximum yearly average ambient air temperature 30 deg.C
 - e) Maximum humidity 100%
 - f) Maximum Wind Pressure 150kg/Sq.m
- 23.2. Due consideration will be given to any special devices or attachment put forward by the Bidder which are calculated to enhance the general utility and the safe and efficient operation of the equipment / material.

D. Submission of Bids.

24. PROCEDURE FOR SUBMISSION OF BIDS:-

- A) The bids should be in the prescribed form, which can be obtained from e-procurement platform from the date of electronic publication up to the time and date indicated in the bid notice. The intending bidders would be required to enroll themselves on the e-procurement market-place www.eprocurement.gov.in. Those contractors who register themselves in the e-procurement market place can download the bid schedules free of cost. The bidder shall authenticate the bid with his digital certificate for submitting the bid electronically on e-procurement platform and the bids not authenticated by digital certificate of the bidder will not be accepted on the e-procurement platform following the G.O.MS.NO.6, IT&C Department, dated. 28-2-2005.
- B) Intending bidders can contact office of the Chief Engineer / Lift Irrigation / Apransco/vidyut soudha/ Hyderabad for any clarification / information on any working day during working hours.
- C) The bidders who are desirous of participating in e-procurement shall submit their bids in the standard formats prescribed in the bid documents, displayed at e-market place. the bidders should invariably upload the statement showing the list of documents etc., in the e-market place in support of their technical bids. The bidder should load scanned copies of all relevant certificates. the bidder shall sign on all the statements, documents, certificates, uploaded by him, owning responsibility for their correctness / authenticity. If any bidder uploads the bid without paying bid security, he will be blacklisted. Similarly if any of the certificates, documents etc., furnished by the bidder are found to be false/fabricated/ bogus, the bidder will be blacklisted and bid security forfeited.
- D) Bid evaluation of the bidders would be done on the certificates/ documents uploaded towards qualification criteria furnished by them. The bidder will invariably complete the bid in full.
- E) The successful bidder shall invariably furnish the following securities / payments before the placing of Order either personally or through courier or by post and the receipt of the same within the stipulated time shall be responsibility of the bidder. Department will not take any responsibility for any delay or non-receipt.
 - I) the original bid security either DD / BG.
 - II) original of all documents / certificates / statements uploaded by him on or before technical bid opening.
 - III) their company broachers, technical write-ups and printed materials if any.

THE BIDDER SHALL FURNISH THE DECLARATION THAT:

- 1) They have not been black listed in any department in A.P. due to any reasons.
- 2) They will agree to get disqualified themselves for any wrong declaration in respect of the above and get their bid summarily rejected.

- 3) The soft copies/ information uploaded by them are genuine. Any incorrectness / deviations noticed will be viewed seriously and apart from canceling the work duly forfeiting the Bid security, criminal action will be initiated including suspension of business and/ or black listing.
25. **Deadline for submission of Bids**
The purchaser may, as its discretion, extend this deadline for the submission of bids by amending the bidding documents in which case all rights and obligations of the Purchaser and Bidders previously subject to the deadline will thereafter be subject to the deadline as extended.
26. **LATE BIDS**
Modification and withdrawal of bids.
No bid may be modified after the deadline for submission of bids.
No bid may be withdrawn in the interval between the deadline for submission of bids and the expiration of the period of bid validity specified. withdrawal of a bid during this interval may result in the forfeiture of its bid security.
- E. **Opening and Evaluation of Bids**
27. **Opening of Bids by the Purchaser.**
- 27.1 The Purchaser will open all the Pre-qualification bids. After Pre-qualification, Technical and commercial analysis ,the Price Bids of the qualified Bidders will be opened on e-platform at a later .
- 27.2.1 If the Technical, Financial & Pre-qualification requirements are found to be inadequate, the Price Bid of such unqualified bidders will not be opened.
- 27.3. Pre-bid meeting will be arranged before opening of the bids. Any clarification sought on the bid should reach this office before pre-bid meeting. But not applicable for this Bid.
28. **Clarification of Bids**
During evaluation of the bids, the Purchaser may, at its discretion, ask the Bidder for a clarification of its, bid. The request for clarification and the response will be in writing, and no change in the prices or substance of the bid will be sought, offered, or permitted.
29. **Preliminary Examination**
29.1 The Purchaser will examine the bids to determine whether they are complete, whether any computational errors have been made, whether required sureties have been furnished, whether the documents have been properly signed, and whether the bids are generally in order.
- 29.2 The Purchaser may waive any minor informality, nonconformity, or irregularity in bid which does not constitute a material deviation, provided such waiver doesn't prejudice or affect the relative ranking of any Bidder.

- 29.3 Prior to the detailed evaluation, the Purchaser will determine the substantial responsiveness of each bid to the bidding documents. For purposes of these clauses, a substantially responsive bid is one, which conforms to all the terms and conditions of the bidding documents without material deviations. Deviations from, or objections or reservations to critical provisions, such as those concerning Bid Security, and Taxes and Duties will be deemed to be a material deviation. The Purchaser's determination of a bid's responsiveness is to be based on the contents of the bid itself without recourse to extrinsic evidence.
- 29.4 If a bid is not substantially responsive, it will be rejected by the Purchaser and may not subsequently be made responsive by the Bidder by correction of the nonconformity.

30. Evaluation and Comparison of Bids.

- 30.1 Bid will be evaluated as a Package. The purchaser will evaluate and compare the Technical & Pre- qualification bids, which have been determined to be substantially responsive. In case the Technical & Pre- qualification requirements are found to be adequate and as required after examination of Bids, Price Bids of the qualified Bidders will opened.
- 30.2 The Purchaser's evaluation of a bid will take into consideration one or more of the following factors:-
All the bids, which are opened, read out and considered for evaluation will be checked for qualification requirements in respect of technical and commercial aspects. Such of the bids, which do not meet the qualification requirements, will not be evaluated further. The bid is to be checked for its conformity to the technical specification. If it does not meet the technical specification, the Bid will not be evaluated further. However, if in the opinion of the purchaser the bidder has offered equipment / material better than the technical specification the same may be considered.

The bid may be rejected for the following reasons:

1. Not in the prescribed form
 2. Insufficient bid security or bid not accompanied by the required bid security or proof of permanent bid security / exemption and not accompanied by Transaction fee
 3. The bidder is a vendor who is banned from further business transactions and the period of ban is still in force.
 4. Bid received after the due date and time.
 5. The bid is through telegram or fax.
- * Further, the purchaser may enquire from the bidder in writing for any clarification of the bid. The response of the bidder will also be in writing. Bids will be examined for completeness and for any computational errors.
- * Arithmetical errors will be rectified on the following basis.
- O Where there is a discrepancy between the unit price and total price, the unit price will prevail and the total price will be corrected accordingly.
 - O Where there is a discrepancy between words and figures, the amount in words

- will prevail.
- O Failure on the part of the bidder to agree to the above corrections will result in rejection of his offer and forfeiture of his bid security.
- * The purchaser's evaluation of a bid shall take into consideration one or more of the following factors Delivery schedule offered in the bid;
- a) Deviations in payment schedule from that specified in the general terms and conditions of the contract and technical deviations.
 - b) The cost of components, mandatory spare parts, and service;
 - c) The availability of spare parts and after-sales services for the equipment offered in the bid;
 - d) The projected operating and maintenance costs during the life of the equipment;
 - e) The performance and productivity of the equipment offered;
 - f) Other specific criteria indicated in the Bidding documents.

In addition the purchaser's evaluation of a bid will take into account the net landed cost of the material at the final destination. for the purpose of evaluation net landed cost is arrived at by adding all elements of the basic price, allowable discount, excise duty, exclusive of CST/VAT & any other levies, packing & forwarding, freight charges, insurance (transit & storage) as quoted by the bidder, interest on advance if any, unloading at final destination, erection, servicing and other charges as called for.

In addition any variation up or down in taxes and duties / new levies introduced subsequent to bid opening and before award will be considered for comparison purposes.

The following criteria may be adopted for taxes and duties for evaluation

- a. **It is the responsibility of the bidder to quote all taxes and duties correctly without leaving any column unfilled. where taxes and duties are not applicable the bidder should enter "na". if no duty / tax is leviable the same may be entered as "nil". if any column is left blank or filled vaguely like "as applicable", the same will be loaded with the maximum of the other eligible bids.**
 - b. **where there is an exemption of ED/ST, the documentary evidence to that effect will be enclosed by the supplier.**
 - c. **The bidders for supply and works shall invariably possess the Tin no. and PAN no.**
- Prior to detailed evaluation, the responsiveness of each bid will be determined. a substantially responsive bid is one that conforms to all the terms and conditions of the bidding documents without material deviations. for this purpose superscription, qualification requirement, bid security, validity, delivery, payment term, price schedule, taxes and duties will be deemed to be the critical provisions and deviations in any one of these items will be deemed to be a material deviation.

The purchaser may waive any minor informality, non-conformity or irregularity in the bid which does not constitute a material deviation, provided such waiver does not affect the relative ranking of any bidder. the purchaser will clearly indicate in the bid specification the methodology for evaluation of bids.

- (a) bid price, which will include all, costs of manufacture and services at manufacturing place as well as, transportation to destination stores, packing and forwarding, insurance and all taxes & other legally permissible duties& levies payable.
 - (b) delivery schedule offered in the bid.
 - (c) deviations in payment schedule from that specified in the general terms and conditions of the contract.
 - (d) the cost of components, mandatory spare parts, and service
 - (e) the availability of spare parts and after-sales services for the equipment offered in the bid;
 - (f) the projected operating and maintenance costs during the life of the equipment;
 - (g) the performance and productivity of the equipment offered; and/or
- OTHER SPECIFIC CRITERIA INDICATED IN THE BID SPECIFICATION.
 - (i) cost of recommendatory spares if any indicated in the relevant price schedule will not be considered for bid evaluation.

30.3 (a) The Purchaser's evaluation of a bid will take into account the Net Landed Cost of the Material at destination stores EXCLUSIVE of CST/VAT and INCLUSIVE of duties quoted by the Bidder. It is the responsibility of the bidder to quote all Taxes and Duties, Freight, Insurance correctly without leaving any column unfilled. Where not applicable the column may be filled as "NA". If no duty / tax is leviable the same may be filled as "NIL". If any column is left blank the same is loaded with maximum of other eligible Bids.

(b) Any statutory variations of taxes and duties and new levies imposed after opening of the bid and before award of the contract will be taken into consideration for the purpose of evaluation.

30.4 A substantially responsive bid is one, which conforms to all the terms and conditions of the bidding documents without material deviations. For this purpose qualification requirement, bid security, validity, delivery, payment terms, taxes and duties will be deemed to the critical provisions and deviations in any one of these things will be deemed to be a material deviation.

31. Contacting the Purchaser.

- 31.1 From the time of the bid opening to the time of contract award, if any Bidder wishes to contact the Purchaser on any matter related to the bid, it should do so in writing.
- 31.2 Any effort by a Bidder to influence the Purchaser in its decisions on bid evaluation, bid comparison, or contract award will result in the rejection of the Bidder's bid.

F. Award of Contract.

32 Post Qualification

- 32.1 In the absence of pre-qualification, the Purchaser will determine to its satisfaction whether the Bidder that is selected as having submitted the lowest evaluated responsive bid is qualified to perform the contract satisfactorily.

The determination will take into account the bidder's financial, and production capabilities. It will be based upon an examination of the documentary evidence of the bidder's qualification submitted by the bidder, as well as such other information as the purchaser deems necessary and appropriate

33 Purchaser's Right to Vary Quantities at Time of Award

- 33.1. The Purchaser reserves the right at the time of contract award to increase or decrease the quantity of Materials / equipment and services originally specified in the Schedule of Requirements without any change in unit price or other terms and conditions.
- 33.2. The purchaser reserves the right to vary the ordered quantity by +/- 50% during the execution of the contract.

34. Purchasers' Right to Accept Any Bid and to Reject any or All Bids.

- 34.1. The Purchaser reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids at any time prior to contract award, without thereby incurring any liability to the affected Bidder or Bidders. The purchaser will inform the affected bidder/bidders of its reasons.

35 Notification of Award.

- 35.1 Prior to the expiration of the period of bid validity the Purchaser will notify the Successful Bidder in writing by registered letter or by cable, to be confirmed in writing by registered letter, that its bid has been accepted.
- 35.2. The notification of award will constitute the formation of the contract.
- 35.3. Upon the successful Bidders' furnishing of the performance security, the Purchaser enters into contract with successful Bidder / Bidders. The Purchaser will notify each unsuccessful Bidder and will discharge its Bid Security.

36. Signing of Contract:

The Purchaser notifies the successful Bidder that its bid has been accepted. Within 30 (thirty days) of receipt of notification of award of Contract, the successful Bidder will sign and date the contract. Failure to comply with this stipulation will entail cancellation of the contract besides forfeiture of the bid security.

37. Performance Security:

- 37.1. Within Fifteen (15) days of receipt of the notification of Contract award. The successful Bidder will furnish to the Purchaser the performance security for an amount 10% of the contract value for proper fulfillment of the contract, which will include the warranty period, and completion of performance obligations including warranty obligations. The performance security will cover 60 days beyond the date of completion of performance obligations including warranty obligations.

In the event of any correction of defects or replacement of defective material during the warranty period, the warranty for the corrected / replaced material will be extended to a further period of 12 months and the Performance Bank Guarantee for proportionate value will be extended 60 days over and above the extended warranty period.

- 37.2. The proceeds of the performance security will be payable to the Purchaser as compensation for any loss resulting from the Supplier's failure to complete its obligations under the Contract.
- 37.3. The performance security will be...
- a). A bank guarantee issued by a scheduled bank acceptable to the Purchaser, in the form provided in the bidding documents. The Bank guarantees may be obtained from the state Bank of India or its associate Banks/ Nationalised Banks.
 - b). A banker's Cheque or crossed DD or Pay Order payable at the Head quarter of the Purchaser in favour of the Purchaser drawn on any scheduled bank.
- 37.4. The performance security will be discharged by the Purchaser and returned to the Supplier not later than sixty (60) days after the expiry date.
- 37.5. Failure of the successful Bidder to comply with the above requirement will entail cancellation of the award and forfeiture of the Bid Security.
- 37.6. In cases where the performance security is not yet paid, the bid security will be forfeited and the balance to make up the performance security deposit will be deducted from pending payments, if any, due to the Tenderer from APTransco on other orders. In addition, the company will also become liable for being black listed by APTransco.

38. Corrupt or Fraudulent Practices

It is essential that the Purchaser as well as Bidder / Supplier / Contractor for the purposes of this provision, the terms set forth below as follows:

- i) "Corrupt practice" means the offering, giving, receiving or soliciting of any thing of value to influence the action of a public official in the procurement process or in contract execution, and
- ii). "Fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the determinant of the purchaser, and includes collusive practice among Bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the purchaser of the benefits of free and open competition.
- iii). Will reject a proposal for award if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question;
- iv). Will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded a contract if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for, or in executing, a contract.

39 Use of Contract Documents and Information:

- 39.1 The Supplier will not, without the Purchaser's prior written consent, disclose the Contract, or any provision thereof, of any specification, plan, drawing, pattern, sample, or information furnished by or on behalf of the Purchaser in connection

therewith, to any person other than a person employed by the Supplier in the performance of the contract. Disclosure to any such employed person will be made in confidence and will extend only so far as may be necessary for purposes of such performance.

39.2 The supplier will not, without the Purchaser's prior written consent, make use of any document or information except for purposes of performing the Contract.

39.3 Any document, other than the Contract itself, will remain the property of the Purchaser and will be returned (in all copies) to the Purchaser on completion of the supplier's performance under the Contract if so required by the Purchaser.

39.4 The Supplier will permit the Purchaser or his authorized representative to inspect the Supplier's accounts and records relating to the performance of the and to have them audited by auditors appointed by the Supplier

40 Patent Rights.

The supplier will indemnify the Purchaser against all third-party claims of infringement of patent, trademark, or industrial design rights arising from use of the Materials / equipment or any part thereof.

41. Places / Locations:

Particulars of site location and nearest rail heads to which the equipments / material have to be supplied will be given to successful Bidders. However it may please be noted that the destinations for supply of materials will be any where in Andhra Pradesh.

42. Delivery:

Delivery period will be reckoned from the date of issue of LOI. The delivery quoted will be firm, definite, unconditional and on the basis of receipt of materials at destination in good condition without any bearing on the procurement of raw materials or any similar prerequisites. The commencement date and date of delivery will be indicted. The preferred delivery time, which is the essence of this specification, is indicated in the schedule. Final deliveries are however, subject to confirmation at the time of Contract. Delay in delivery of materials FADS – (Free At Destination Store) due to non-availability of railway booking, non-allotment of wagons and any such reasons will not be considered.

It is the responsibility of the supplier to make alternative arrangements for transporting the materials by road or rail so as to see that the material reaches the destination within the stipulated period. The Purchaser reserves its right to defer the delivery date at any time after orders are placed without any change in the conclusion of contract other conditions supply. The delivery period, which will be reckoned from the date of the contract, will be guaranteed under penalty as in Clause 60.

43. Inspections and tests:

(i) The supplier will keep the purchaser informed in advance of the time of the starting and the progress of manufacture of equipment in its various stages so that arrangement could be made for inspection. The accredited representative of the APTRANSCO will have access to the supplier's or his subcontractor's work at any time during working hours for the purpose of inspecting the materials during manufacturing of the materials / equipment and testing and may select test samples from the materials going into plant and equipment.

The supplier will provide the facilities for testing such samples at any time including access to drawings and production data at no charge to Purchaser. As soon as the materials are ready the supplier will duly send intimation to APTRANSCO by Regd. Post and carry out the tests in the presence of representative of the APTRANSCO.

- ii) The APTRANSCO may at its option get the materials inspected by the third party if it feels necessary and all inspection charges in this connection will be borne by the supplier.
- iii) The dispatches will be affected only if the test results comply with the specification. The dispatches will be made only after the inspection by the APTRANSCO Officer is completed to the APTRANSCO satisfaction or such inspection is waived by the competent authority.
- iv) The acceptance of any quantity of materials will in no way relieve the supplier of its responsibility for meeting all the requirements of this specification and will not prevent subsequent rejection if such materials are later found to be defective.
- v) The supplier will give 15 days advance intimation to enable the Purchaser depute his representative for witnessing the acceptance and routine tests.
- vi) Should any inspected or tested materials / equipment fail to conform to the specification, the Purchaser may reject the materials and supplier will either replace the rejected materials or make alterations necessary to meet specifications requirements free of costs to the Purchaser.
- vii) Inspection will be conducted on 20% of the quantities offered for inspection. Samples will be collected at random to establish that the guaranteed technical parameters are as per the submitted bid by the supplier. In the case of non-adherence, the purchaser may take suitable action on the supplier including cancellation of vendor registration and banning further dealings, depending on the gravity of the deviation. These random inspections may be entrusted to a third party.
- viii). The inspection of the material shall be arranged at the manufacturer premises. In case it is of abroad, the supplier shall bear the to and fro charges, local transport and accommodation at inspection place for the inspecting officer

44. Name Plate:

Equipment should be provided with name plate giving full details of manufacture, capacities and other details as specified in the relevant ISS or other specification stipulated. The contract No. and date and year of supply and the words "APTRANSCO" must be etched on the name plate.

45. Packing:

- 45.1. The supplier will provide such packing of the Materials / equipment as is required to prevent their damage or deterioration during transit to their final destination, as indicated in the Contract. The packing will be sufficient to withstand, without limitation, rough handling during transit and exposure to extreme temperatures, salt and precipitation during transit, and open storage. Packing case size and weights will

take into consideration, where appropriate, the remoteness of the Materials / equipment final destination and the absence of heavy handling facilities at all points in transit.

- 45.2. The packing, marking, and documentation and outside the packages will comply strictly with such special requirements as will be expressly provided for in the Contract and in any subsequent instructions ordered by the Purchaser. The supplier will be required to make separate packages for each consignee, each package will be marked on three sides with proper paint/ indelible ink with following;

1. Contract number
2. Supplier's Name
3. Packing list reference number

- 45.3. The supplier, whenever dispatches materials to a destination should prepare the following information in the form of packing slip in quadruplicate and send the same to the consignee and obtain his acknowledgement. The consignee will return to the supplier one copy of the packing slip with his remarks. The proforma of packing slip will be as follows:

PACKING SLIP

1. Contract No. & Date.
2. Quantity allotted to the stores and rate applicable.
3. Quantity so far supplied to the stores and the rate applied.
4. Quantity now supplied and the rate applied.
5. Total quantity supplied under the contract with rates applied.
6. Programme for supplying the balance quantity to the stores.

46. Delivery Documents

- 46.1. Delivery of the Materials / equipment will be made by the supplier in accordance with the terms specified in the contract.

The latest test certificates containing the result of the tests as per the relevant ISS or other specification stipulated must be submitted to the Chief Engineer and got approved by him.

- 46.2. Documents to be submitted by the Supplier are specified as under..

- i. Insurance certificate;
- ii. Supplier's certificate certifying that the defects if any pointed out during inspection have been rectified (3 copies).
- iii. Manuals in Six sets and one set of reproducible drawings.

The purchaser will receive the above documents soon after the dispatch of materials and if not receive, the supplier will be responsible for any consequent expenses.

47. Insurance

- 47.1. The Materials / equipment supplied under the contract will be fully insured against loss or damage incidental to manufacture or acquisition, transportation and delivery and also storage for 45 days at destination site/ stores before taking into stock.

The insurance will be in an amount equal to 100% FADS value of

Materials/equipment on all risks basis. The policy will have a provision for extension to cover further storage if necessary at destination stores / site at APTRANS CO cost. The supplier will take the insurance cover in the name of purchaser.

- 47.2 The Bidder shall a) Initiate and pursue insurance claim till settlement and b) Promptly arrange for repair and/or replacement of any damaged items in full irrespective of settlement of insurance claim by the under writers. c) All costs because of insurance liabilities covered under the contract will be to supplier's account. The supplier shall provide the purchaser with a copy of all insurance policies and documents taken out by him in pursuance of the 'Contract'. Such copies of documents shall be submitted to the purchaser immediately after such insurance coverage. The supplier shall also inform the purchaser in writing at least sixty (60) days in advance, regarding the expiry, cancellation and/or change in any of such documents and ensure revalidation/renewal etc., as may be necessary well in time.

The risks that are to be covered under the insurance shall be comprehensive and shall include but not limited to, the loss or damage in transit, storage, due to theft, pilferage, riot, civil commotion, weather conditions, accident of all kinds, fire, flood, war risk (during ocean transportation) bad or rough handling etc., The scope of such insurance shall cover the entire contract value.

48. Transportation:

The supplier is required under the Contract to transport the Materials / equipment to a specified place of destination defined as normally the district stores, transport to such place of destination, including insurance and storage, will be arranged by the supplier, and the related costs will be included in the Contract Price only.

49. Incidental Services

- 49.1 The supplier may be required to provide any or all of the following services, including additional services, if any.

- (a). Performance or supervision of on – site assembly and / or start-up of the supplied material / equipment;
- (b). Furnishing of tools required for assembly and/or maintenance of the supplied Materials/ equipment.
- (c). Furnishing of a detailed operations and maintenance manual for each appropriate unit of the supplied Materials / equipment;
- (d). Performance or supervision or maintenance and / or repair of the supplied Materials / equipment, during warranty period, provided that this service will not relieve the Supplier of any warranty obligations under this contract; and
- (e). Training of the Purchaser's personnel, at the Supplier's plant and/or on-site, in assembly, start-up operation, maintenance, and/or repair of the supplied Materials / equipment.

50. Spare parts:

- 50.1 supplier may be required to provide any or all of the following materials, notifications, and information pertaining to spare parts manufactured or distributed by the supplier.

- (a). Such spare parts as the Purchaser may choose to purchase from the supplier, provided that this selection will not relieve the supplier of any warranty obligations under the contract; and
- (b). In the event of termination of production of the spare parts:
- (c). Advance notification to the Purchaser of the impending termination.

- (d). Time to permit the Purchase to procure needed requirement; and following such termination, furnishing at no cost to the Purchaser, the blueprints, drawings, and specifications of the spare parts, if requested.
- 51. Warranty:**
- 51.1. The supplier will warrant for the satisfactory functioning of the material / equipment as per specification for a minimum period of 18 months from the date of receipt of the material / equipment in good condition or one year (12 months) from the date of successful erection & commissioning of the equipment indicated at section – IV (SOR) in full shape, whichever period concludes later.
- 51.2. The supplier warrants that the Materials / equipment supplied under the Contract are new, unused of the most recent or current models, and that they incorporate all recent improvements in design and materials unless provided otherwise in the Contract. The supplier further warrants that all Materials / equipment supplied under this contract will have no defect, arising from a design and / or materials as required by the Purchaser's specifications or from any act of omission of the Supplier, that may develop under normal use of the supplied Materials / equipment.
- 51.3. All the material will be of the best class and will be capable of satisfactory operation in the tropics under service conditions indicated in clause 21 without distortion or deterioration. no welding, filling or plugging of defective parts will be permitted, unless otherwise specified, they will conform to the requirements of the appropriate Indian, British or American standards. (where a standard specification covering the material in question has not been published, the standards of the American society for testing of materials should be followed).
- 51.4. The entire designs and construction will be capable of withstanding the severest stress likely to occur in actual service and of resisting rough handling during transport.
- 51.5. Unless otherwise specified the warranty period will be 18 months from the date of acceptance of the Materials / equipment. The Supplier will, in addition, comply with the performance guarantees specified under the contract. If, for reasons attributable to the Supplier, these guarantees are not attained in whole or in part, the supplier will at its discretion either, Make such changes, modifications, and/or additions to the Materials / equipment or any part thereof as may be necessary in order to attain the contractual guarantees specified in the contract at its own cost and expense and to carry out further performance tests as per the relevant standards.
- 51.6. The purchaser will promptly notify the supplier in writing of any claims arising under this warranty.
- 51.7. "Upon receipt of such notice, the Supplier will within 30 days repair or replace the defective Materials / equipment or parts thereof, free of cost at the ultimate destination. The supplier will take over the replaced parts / Materials / equipment at the time of their replacement. No claim whatsoever will lie on the Purchaser for the replaced parts / Materials / equipment thereafter". In the event of any correction of defects or replacement of defective material during the warranty period, the warranty for the corrected / replaced material will be extended to a further period of 12 months.
- 51.8. If the supplier, having been notified, fails to remedy the defect(s) within the above period, the Purchaser may proceed to take such remedial action as may be necessary,

at the Supplier's risk and expense duly deducting the expenditure from subsequent bills / bank guarantee and without prejudice to any other rights which the Purchaser may have against the supplier under the contract.

52. Payment for supply of material/equipment:-

52.1 All the bidders who shall accept the following terms of payment are only acceptable. Bids received stipulation terms other than the following terms will be invalidated.

The payment shall be made in the following manner:

A. For equipment/Material

Advance Payment: 10% of the Contract Price(FOR Destination) for schedule shall be paid by JICA through transfer Procedure within 30 days of signing of the contract against a simple receipt and an unconditional bank guarantee issued by a bank which is acceptable to the purchaser for the equivalent amount valid until the goods are delivered and in the form provided in the bidding documents.

- i) **On Delivery:** 80% of the FOR Destination Price of Goods/material received (against detailed breakup cost to be supplied by Supplier in advance) shall be paid under Transfer Procedure for JICA ODA Loans, on submission of documents listed as per specification against Form-13 that the amounts shown in the invoice are correct in terms of the contract. The concerned Assistant Executive Engineer/TLC will receive the equipment/material in full shape at site and the concerned Divisional Engineer/Telecom and Executive Engineer/ TLC will do the check measurement and issue the Form-13.
- ii) The contractor shall furnish the following documents in quadruplicate for arranging payment for the equipment/material supplied.
 - a) Copies of the invoices showing contract no. Goods description, quantity, unit price and total amount.
 - b) Acknowledgement of receipt of material from consignee i.e Form,-13
 - c) Acknowledgement of Consignee on delivery challan in original.
 - d) Detailed packing list.
 - e) Documentary proof for the freight.
 - f) Copies of Insurance Certificate/policies.
 - g) Test certificates approval and dispatch clearance. (Not applicable for furniture and general items).
 - h) Certificate certifying that the defects. If any pointed out during inspection have been rectified.
- iii) No payments will be made for the supplies made prior to scheduled delivery date or for materials which are not in full shape.

On Completion: Five (5) percent of the FOR Destination Price of the Goods/Material, received shall be paid within thirty (30) days of under the Transfer procedure for JICA ODA Loans upon submission of claim supported by the completion certificate issued by the purchaser. The Divisional Engineer/Telecom & Executive Engineer/TLC will arrange for completion certificate after erection of the equipment/material.

On Acceptance: Five (5) percent of the FOR Destination Price of the Goods,

received shall be paid within thirty (30) days of under the Transfer procedure for JICA ODA Loans upon submission of claim supported by the commissioning certificate issued by the purchaser. The concerned Divisional Engineer/Telecom and Executive Engineer/TLC will arrange for commissioning certificate after erection of the equipment/material. (or) against submission of Bank guarantee for the value with a validly period of guarantee period.

All statutory taxes and duties shall be paid by the supplier initially as per the prevailing rates during the delivery of the entire consignments. Such taxes will be reimbursed to contractor with in thirty days on submission of proof of payment by PFC directly and on receipt of materials at APTRANSCO Stores/Site.

The Prices indicated in contract order will be paid in the regular bills. The price variation bills shall be paid separately after approval of relevant price variation claims and after deduction of recoveries/ penalties if any against supplies.

B. for Works

- i) **Ten (10) percent** of and total unit price of schedule-B shall be paid from JICA through transfer procedure as initial advance on submission of a bank guarantee valid for 30 days beyond completion of works in format given in the document.
- ii) **Eighty (80) percent** of the Total unit price of Schedule –B completed shall be paid from JICA through transfer procedure on actual completion of installation at site and after due inspection and approval of the purchaser, with in 30 days from such inspection.

On Completion of Total Work:

Five (5) percent of the total unit price of schedule-B shall be paid to the contractor within 30 days after the date of the completion certificate through transfer procedure for the respective work issued by the purchaser.

On completion of Performance Guarantee Period: Five (5) percent of the Total unit Price of schedule-B shall be paid by transfer procedure to the contractor within 30 days after successful commissioning of the substation upon submission of claim supported by the commissioning certificate issued by the purchaser. (or) against submission of Bank Guarantee for the value with a value with a validity period of guarantee period.

Transfer Procedure:

Under this procedure, claims received from the supplier/Contractor supported by pre-receipted invoice for the amount to be paid and other documents as specified above will be sent to JICA, Japan through Govt.of India within days of request for such payment. JICA Japan will be paying into the non-resident yen account of the Govt.of India in the Designated Foreign exchange Bank. Tokyo, Japan. Exchange rate adopted for this shall be yens calculated at the T/T selling rates quoted by designated Foreign exchange. Tokyo, Japan. Two business bank days before the date of disbursement (Payment) JICA into the Bank actually made.

After receiving the disbursement amount, Designated Foreign Exchange Bank Tokyo, Japan will immediately transfer the exact amount to the respective suppliers bank in India which in turn will credit the amount into the suppliers account. APTRANSCO and JICA. Japan will not be liable for any loss due to variation in the exchange rate as on the date of disbursement by JICA, Japan and that at the time of transfer.

Payments will be made by/RTGS from JICA/PFC/APTRANSCO funds BANK

funding. The contractor has to furnish requisite details for establishing RTGS in proforma as per Schedule. -X. Once RTGS system is established the bank account details submitted are final and cannot be changed till completion of the contract. An amount of Rs.50/- will be recovered from the bill amount for each disbursement on LOA raised by unit offered towards RTGS.

- 52.2. The 100% payment mentioned above is subject to on submission of performance security in advance as per Clause 35 by the supplier.
- 52.3. The supplier should invariably submit test certificates and other documents, the purchaser specifies as soon as dispatch is made so that they can be checked and approved well in advance.
- 52.4. The performance guarantee to be executed in accordance with this specification will be furnished on a stamp paper of value Rs.100/-. The Bank Guarantee will be extended if required suitably. In accordance with the provisions of clause No.35.
- 52.5. If the supplier has received any over payments by mistake or if any amounts are due to the APTRANSCO due to any other reason, when it is not possible to recover such amounts under the contract resulting out of this specification, the APTRANSCO reserves the right to collect the same from any other amount and / or Bank Guarantees given by the company due to or with the APTRANSCO.
- 52.6. When the supplier does not at any time, fulfill his obligations in replacing / rectifying etc. of the damaged / defective materials in part or whole promptly to the satisfaction of the APTRANSCO Officers, the APTRANSCO reserves the right not to accept the bills against subsequent dispatches made by the supplier and only the supplier will be responsible for any demurrages, wharfages or damage occurring to the consignments so dispatched.

53. Prices

- 53.1. Prices charged by the supplier for Materials / equipment delivered and services performed under the contract will not vary from the prices quoted by the supplier in its bid, with the exception of any price adjustment authorized in the contract.

54. Change orders:

- 54.1. The purchaser may at any time, by a written order given to the Supplier make changes within the general scope of the Contract in any one or more of the following:
 - a) Drawings, designs, or specifications, where Materials / equipment to be furnished under the contract are to be specifically manufactured for the Purchaser.
 - b) The method of shipment or packing;
 - c) The place of delivery, and / or
 - d) The Services to be provided by the Supplier.

55. Contract Amendments

- 55.1. No variation in or modification of the terms of the Contract will be made except by written amendment by the Purchaser and accepted by the supplier.

56. Assignment

- 56.1. The supplier will not assign, in whole or in part, its obligations to perform under this Contract, except with the Purchaser's prior written consent.

57. Delays in Supplier's Performance

57.1. Delivery of the Materials / equipment will be made by the Supplier in accordance with the time schedule prescribed by the Purchaser in the Schedule of Requirements.

57.2. If at any time during performance of the contract, the supplier should encounter conditions impeding timely delivery of the Materials / equipment, the Supplier will promptly notify the Purchaser in writing of the fact of the delay, its likely duration and its cause(s). As soon as practicable after receipt of the Supplier's notice, the Purchaser will evaluate the situation and may at its discretion extend the Supplier's time for performance, with or without liquidated damages, in which case the extension will be ratified by the parties by amendment of the Contract.

57.3. Except as provided under force majeure clause a delay by the Supplier in the performance of its delivery obligations will render the Supplier liable to the imposition of liquidated damages unless an extension of time is agreed upon without the application of liquidated damages.

58. Penalty for delay in supplies

The time for and the dates for delivery mentioned in the contract will be deemed to be the essence of the contract. Subject to force majeure clause No.62, if the supplier fails to deliver any or all of the Materials / equipment or to perform the Services within the period(s) specified in the Contract, the Purchaser will, without prejudice to its other remedies under the Contract, deduct from the Contract Price, as liquidated damages, a sum equivalent to 0.5% per week on the undelivered portion subject to a maximum of 5% of the total value of the contract. Once the maximum is reached the Purchaser may consider termination of the contract.

The date of Form-13 i.e., the date of receipt of materials at destination stores in good condition will be taken as the date of delivery. Materials / Equipment which are not of acceptable quality or are not confirming to the specification would be deemed to be not delivered. For penalty, the number of days would be rounded off to the nearest week and penalty calculated accordingly.

The penalty specified above will be levied and would be adjusted against subsequent pending bills.

Any failure on the part of new vendors for a second time would cause them to be removed from the list of registered vendors.

59. Termination for Default

The purchaser, without prejudice to any other remedy for breach of contract, by written notice of default sent to the Supplier, may terminate this Contract in whole or in part:

- i. If the supplier fails to deliver any or all of the Materials / equipment within the period(s) specified in the Contract, or within any extension thereof granted by the Purchaser.
- ii. If the supplier fails to perform any other obligations under the contract.
- iii. If the supplier, in the judgment of the purchaser has engaged incorrupt or fraudulent practices in competing for or in executing the contract.

59.1. In the event the Purchaser terminates the Contract in whole or in part, the purchaser may procure, upon such terms and in such manner, as it deems appropriate, Materials / equipment or services similar to those undelivered, and the supplier will be liable

to the Purchaser for any excess costs for such similar Materials / equipment or Services. However, the Supplier will continue performance of the contract to the extent not terminated

60. Termination for Insolvency.

60.1. The Purchase may at any time terminate the Contract by giving written notice to the Supplier if the Supplier becomes bankrupt or otherwise insolvent. In this event, termination will be without compensation to the supplier, provided that such termination will not prejudice or not affect any right of action or remedy, which was accrued or will accrue thereafter to the Purchaser.

61. Termination for Convenience.

61.1 The Purchase, by written notice sent to the Supplier, may terminate the Contract, in whole or in part, at any time for its convenience. The notice of termination will specify the termination is for the Purchaser's convenience, the extent to which performance of the supplier under the Contract is terminated, and date upon which termination becomes effective.

61.2. However the Materials / equipment that are complete and ready for shipment within thirty (30) days after the supplier's receipt of notice of termination will be accepted by the Purchaser at the Contract terms and prices.

62. Force Majeure

62.1. The Supplier will not be liable for forfeiture of its performance security, penalty for late delivery, or termination for default if and to the extent that its delay in performance or other failure to perform its obligations under the Contract is the result of an event of Force Majeure.

62.2. For purposes of this clause, "force majeure" means an event beyond the control of the supplier and not involving the supplier's fault or negligence and not foreseeable. such events may include, but are not restricted to, wars or revolutions fires, floods, epidemics, quarantine restrictions, and freight embargoes.

62.3. If a Force Majeure situation arises, the supplier will promptly notify the Purchaser in writing of such condition and the cause thereof. Unless otherwise directed by the Purchaser in writing, the Supplier will continue to perform its obligations under the Contract as far as is reasonably practicable, and will seek all reasonable alternative means for performance not prevented by the Force Majeure event.

No price variance will be allowed during the period of force measure.

63. Settlement of Disputes:

63.1. If any dispute or difference of any kind whatsoever will arise between the Purchaser and the Supplier in connection with or arising out of the Contract, the parties will make every effort to resolve amicably such dispute or difference by mutual consultation.

63.2. If, after thirty (30) days the parties have failed to resolve their dispute or difference by such mutual consultation, then either the purchaser or the supplier may give notice to the other party of its intention of commence arbitration, as hereinafter provided, as to the matter in dispute, and no arbitration in respect of this matter may be commenced unless such notice is given.

63.3. Any dispute of difference in respect of which a notice of intention to commence

arbitration has been given in accordance with this clause will be finally settled by arbitration. Arbitration may be commenced prior to or after delivery of the Materials / equipment under the Contract.

63.4. Arbitration proceedings will be conducted in accordance with the following rules of procedure. The dispute resolution mechanism will be as follows:

- (a) In the case of a dispute or difference arising between the Purchaser and a supplier relating to any matter arising out of or connected with this agreement, such dispute or difference will be settled in accordance with the Arbitration and Conciliation Act, 1996. The Arbitral Tribunal will consist of three Arbitrators one each to be appointed by the Purchaser and the supplier the Third Arbitrator will be chosen by the Two Arbitrators so appointed by the parties and will acts as Presiding Arbitrator. In case of failure of the two Arbitrators appointed by the parties to reach upon a consensus within period of 30 days from the appointment of the Arbitrator appointed subsequently, the Presiding Arbitrator will be appointed by the Institution of Engineers (India).
 - (b) If one of the parties fails to appoint its Arbitrator in pursuance of Sub-Clause (a)within 30 days after receipt of the notice of the appointment of its Arbitrator by The Institution of Engineers (India), will appoint the Arbitrator. A certified copy of the order of the Institution of Engineers (India), making such an appointment will be furnished to each to the parties.
 - (c) Arbitration Proceedings will be held at Purchaser's Headquarters, and the language of the Arbitration proceedings and that of all documents and communication between the parties will be English.
 - (d) The decision of the majority of Arbitrators will be final and binding upon both parties. The cost expenses of Arbitration Proceedings will be paid as determined by the Arbitral Tribunal. However, the expenses incurred by each party in connection with the preparation, presentation etc. of its proceedings as also the fees and expenses paid to the Arbitrator appointed by such party or on its behalf will be borne by each party itself.
 - (e) Where the value of the Contract is Rs. One Crore and below, the disputes or differences arising will be referred to the Sole Arbitrator. The Sole Arbitrator should be appointed by agreement between the parties, failing such agreement, by the appointing authority namely The Institution of Engineers (India).
- 63.5 Not notwithstanding any reference to arbitration herein,
- a) The parties will continue to perform their respective obligations under the Contract unless they otherwise agree; and
 - b) The Purchaser will pay the Supplier any monies due to the Supplier.

64. Jurisdiction

64.1 All and any disputes or differences arising out of or touching this contract will be decided by the Courts or Tribunals situated in Purchaser's Headquarters only. No suit or other legal proceedings will be instituted elsewhere.

65. Notices

65.1 Any notice given by one party to the other pursuant to this Contract will be sent to the

other party in writing or by cable, telex, or facsimile and confirmed in writing to the other party's address.

- 65.2 A notice will be effective when delivered or on the notice's effective date, whichever is later.

66. Foreign Exchange

- 66.1 No Foreign Exchange is available or expected for this purchase. Offers which do not require release of F.E. or procurement of import license by APTRANSCO only will be considered. Where some of the components are to be imported the manufacturer will have to make their own arrangements for import license etc., and should not look for any assistance from APTRANSCO.

SECTION - IV

SCHEDEULE OF REQUIREMENTS

| SL no. | Description | Qty | Unit | Delivery schedule | Destinatio n | Bid security |
|--------|--|-----|------|--|--|----------------|
| | Supply, erection & commissioning of under ground optical fibre cable, OPGW & OLTE along with associated equipment for providing communication to 220kv & 132kvss in Hyderabad metropolitan area under JICA funding | | | | | |
| 1 | OPGW 24F of DWSM type including sag, loop, overheads @ 30% including all hardware accessories | 57 | Kms | | | |
| 2 | Splice boxes (OPGW - OFAC) | 3 | Nos. | | | |
| 3 | Splice boxes (OPGW - OPGW) | 19 | Nos. | | | |
| 4 | Down lead clamps | 190 | Nos. | | | |
| 5 | Underground O.F.cable unarmoured 48F DWSM type (40F g 652d + 8F G-655) (cable portion taken 30% extra on actual length) | 116 | Kms | | | |
| 6 | Splice boxes 48F U/G (joint closures) | 54 | Nos. | | | |
| 7 | Unidirectional Managed Synchronous Digital Hierarchy (SDH) type, short haul that can drive upto 60 km, STM-4 upgradable to STM-16 OLTE with Primary Multiplexer | 10 | Sets | Delivery of the equipment shall be completed within 4 months from the date of issue of LOI and erection & commissioning shall be completed with in five (6) months from the date of issue of LOI | Hyderabad metropolit an area, Andhra Pradesh | Rs. 16.7 Lakhs |
| 8 | Digital protection signaling equipment | 12 | Sets | | | |
| 9 | Two directional Managed Synchronous Digital Hierarchy (SDH) type, short haul that can drive upto 60 km, STM-4 upgradable to STM-16 OLTE with Primary Multiplexer | 8 | Sets | | | |
| 10 | Network management system for SDH& MUX along with software and configuration tool and furniture (PC-1 no, Chair-01 no, Table-1 no, Printer-1 no) | 1 | No | | | |

| | | | | | |
|----|--|------|------|--|--|
| 11 | Fibre distribution panels for termination of fibres of 48F capacity | 26 | Nos. | | |
| 12 | Fibre approach cable (DWSM) of 24 fibre capacity with HDPE pipe | 1500 | mtrs | | |
| 13 | Epax (16/16) with 2 E1 cards wired for 128 ports | 12 | Nos. | | |
| 14 | EPB telephones | 40 | Nos | | |
| 15 | 48V/50A (1+1) SMPS Float Cum Boost Charger | 3 | Nos. | | |
| 16 | 48V/35A(1+1)SMPS Float Cum Boost Charger | 5 | Nos. | | |
| 17 | 48v/250AH SMF VRLA battery set | 3 | Nos. | | |
| 18 | 48V/200AH SMF VRLA battery set | 5 | Nos. | | |
| 19 | 6 pair PVC copper telephone cable | 1.6 | Km | | |
| 20 | Single pair PVC copper telephone cable | 1.6 | Km | | |
| 21 | 25 sqmm battery cable | 1.6 | Km | | |
| 22 | Optical Time Domain Reflector (OTDR) | 2 | Nos | | |
| 23 | Fusion splicing machine (FSM) along with standard accessories | 2 | Nos | | |
| 24 | Optical power meter | 2 | Nos | | |
| 25 | OFC tool kit consisting of fibre stripping tool and tools for cutting and stripping of sheathing, jacket armouring of OFAC/ADSS/OPGW cables including two binoculars | 2 | Nos. | | |
| 26 | SDH STM4/16 analyzer with optical and electrical interfaces | 2 | Nos | | |
| 27 | 1.5 ton split type AC units of 3 star rating including 4 kVA Voltage stabiliser | 15 | Nos. | | |
| | Spares | | | | |
| 28 | Suspension assembly for OPGW (grounding clamps are part of suspension assembly) | 2 | Nos | | |
| 29 | Tension assembly for OPGW(dead end clamps and grounding clamps are part of tension assembly) | 14 | Nos. | | |
| 30 | Vibration dampers for OPGW | 32 | Nos. | | |
| 31 | Splice boxes (OPGW - OPGW) | 2 | Nos. | | |
| 32 | Splice boxes (OPGW - OFAC) | 2 | Nos | | |
| 33 | Down lead clamps | 20 | Nos | | |
| 34 | Mandatory spare set for OLTE / MUX | 2 | Sets | | |
| 35 | Epax spare set | 2 | Nos. | | |
| 36 | Mandatory spare set (one module for each type) for digital teleprotection | 2 | Nos | | |

| | | | | | | |
|----|---|------|-----------|--|--|--|
| 37 | Spare set of 48V/50A SMPS Float Cum Boost Charger | 1 | Set | | | |
| 38 | Spare set of 48V/35A SMPS float cum boost charger | 1 | Set | | | |
| | Erection & commissioning charges for equipment | | | | | |
| 39 | Erection & commissioning of OPGW | 57 | Kms | | | |
| 40 | Erection & commissioning of 48 fibre underground OFC through 40/ 33 mm dia HDPE duct including end termination in FDMS with splicing and testing of 48 Fibre OFC from end to end stations | 116 | Kms | | | |
| 41 | Erection and commissioning of OLTE, MUX , DTP and associated equipment | 30 | Locations | | | |
| 42 | Erection & commissioning of OFAC | 1500 | Mtrs. | | | |
| 43 | Erection & commissioning of fibre distribution panels for termination of fibres of 48 F capacity | 26 | Nos | | | |
| 44 | Erection and commissioning of EPAX (16/16) | 12 | Nos | | | |
| 45 | Erection and commissioning of 48V charger | 8 | Nos | | | |
| 46 | Erection and commissioning of 48V SMF VRLA battery set | 8 | Nos | | | |
| 47 | Erection and commissioning of 1.5 ton split type AC units along with electrical wiring and mounting stand. | 15 | Nos | | | |

Note: 1).All the above items are given in the commercial form under mechanical accessories with respective quantities. Bidder shall quote unit Ex works prices for all these items under mechanical accessories. Basic price per unit in the commercial form shall be the total Ex works price of all items except at Items 39 to 47 multiplied by the respective quantity. Where as the Total Ex works cost of Items 39 to 47 shall be indicated against Erection & Commissioning Column in the Commercial Evaluation Form.

2). The details of equipment to be erected and commissioned are at Annexure-I(A) & Annexure-I(B).

ANNEXURE -I-A
Station wise details of the Sub-Station equipment to be commissioned

| Sl. No. | Particulars | 220KVSS Malkaram | 220 KVSS Gunrock | 220KVSS Chandrayangutta | 220 KVSS Imlibun | 132KV Osmania University | 132 KVSS Chikakalaguda | 132KVSS Erragadda | 132KVSS Balkampet | 132KVSS Patigadda | 132KVSS Hussainsagar | 400/220KVSS Ghanapur | 220 KVSS Hayatnagar | PTO (Miralam Filter Bed) GIS | 132 Moosarambagh GIS | 132KVSS Narayananagud | Total Qty | UOM | |
|---------|--|------------------|------------------|-------------------------|------------------|--------------------------|------------------------|-------------------|-------------------|-------------------|----------------------|----------------------|---------------------|-------------------------------|----------------------|-----------------------|-----------|-----|--------------|
| 1 | Erection and commissioning of OLTE, MUX , DTP and associated equipment | 3 | 3 | 3 | 4 | 1 | 1 | 1 | 1 | 2 | 1 | 3 | 3 | 1 | 1 | 1 | 1 | 30 | Loca tion |
| 2 | Erection & Commissioning of OFAC | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1.5 | Km |
| 3 | Erection & commissioning of Fibre distribution panels for termination of Fibres of 48 F capacity | 1 | 2 | 1 | 3 | 2 | 1 | 1 | 2 | 3 | 1 | 2 | 1 | 1 | 2 | 1 | 2 | 26 | Nos |
| 4 | Erection and commissioning of EPAX (16/16) | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 12 | Nos |
| 5 | Erection and commissioning of 48V Charger | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 8 | Nos |
| 6 | Erection and commissioning of 48V SMF VRLA Battery set | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 8 | Nos |
| 7 | Erection and commissioning of AC Units along with electrical wiring. | 0 | 2 | 0 | 2 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 2 | 1 | 1 | 1 | 1 | 15 | Nos |

ANNEXURE -I-B

Details of providing OFC Communication in Overhead and UG-OFCable Works in Hyderabad Metropolitan area under JICA funding

| | S.No. | Particulars | | | | | | | | | | | | Total Qty in Kms | |
|---|---|--|---|---|--|---|---|--|--|---|---|---|--|------------------|--|
| | | 220KV Malkaram - 220 KV Gunrock SS U/G DC line | 220KV Chandrayangutta - 220 KV Imlibun SS U/G DC line | 132KV Osmania University - 132 KV Chilakalaguda U/G SC line | 132KV Erragadda- 132KV Balkampet U/G SC line | 132KV Balkampet- 132KV Pattigadda U/G SC line | 132KV Patigadda -132KV Hussainsagar U/G SC line | 400/220KV Ghanapur- 220 KV Hayatnagar DC U/G line/ OH Multi circuit line | 132 KV Pattigadda-132 KV Gunrock U/G DC line | 132KV Imlibun - PTO (Miralam Filter Bed) U/G DC line | L1LO of OH 132KV Ghanapur- Imlibun line to 132 Moosarambagh GIS U/G SC line | 132KV Narayananaguda-132KV Fever Hospital U/G SC line | 132KV Fever Hospital- 132KV Osmania University U/G DC line | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | |
| | | Qty | Qty | Qty | Qty | Qty | Qty | Qty | Qty | Qty | Qty | Qty | Qty | Qty | |
| 1 | Erection & Commissioning of OPGW | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 34 | 0 | 0 | 57 | |
| 2 | Erection & commissioning of 48 Fibre OFC through 40/ 33 mm dia HDPE DUCT including end termination in FDMS with splicing and testing of 48 Fibre OFC from end to end stations | 23 | 16 | 8 | 8 | 12 | 9 | 10 | 10 | 5 | 2 | 5 | 8 | 116 | |

ANNEXURE-I-C

Tentative Data Sheet to arrive cost of OPGW per KM including hardware accessories

| S.No | Description | Qty per Km |
|------|---------------------|------------|
| 1 | OPGW | 1 Km |
| 2 | Suspension assembly | 1 No |
| 3 | Tension assembly | 7 Nos |
| 4 | Vibration dampers | 16 Nos |

NOTE: The above quantity of hardware accessories are minimum tentative to arrive the cost of OPGW per km. However the hardware accessories to be supplied, erected & commissioned shall be as per field requirements as per survey.

DETAILS OF SUB-STATION EQUIPMENT LINewise

| O Z - O | | | | | | | | | | | | Description of Equipment | UOM |
|---------|--|---|---|---|---|---|---|---|---|---|---|--|--|
| 1 | 2 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 1 | Uni directional Managed Synchronous Digital Hierarchy (SDH) type, short Haul that can drive upto 60 Km, STM-4 upgradable to STM-16 OLTE with Primary Multiplexer | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 220KVSS Malkaram 220 KVSS Gunrock | 220kV Malkaram-220kV Gunrock SS U/G DC line |
| 2 | Digital Protection Signalling Equipment | 2 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 220KVSS Chandrayangutta 220 KVSS Imlibun | 220kv Chandrayanagutta- 220kv Imlibun SS U/G DC line |
| | | | | | | | | | | | | 132KV Osmania University 132 KVSS Chilakalaguda | 132kV Osmania University - 132kV Chilakalaguda U/G SC line |
| | | | | | | | | | | | | 132KVSS Erragadda 132KVSS Balkampet | 132kV Erragadda -132kV Balkampet U/G single line |
| | | | | | | | | | | | | 132KV SS Balkampet 132KVSS Pattigadda | 132kV Balkampet – 132kV Patigadda U/G S/C line |
| | | | | | | | | | | | | 132KVSS Patigadda 132KVSS Hussainsagar | 132kV Patigadda – 132kV Hussainsagar U/G SC line |
| | | | | | | | | | | | | 400/220KVSS Ghanapur 220 KVSS Hayatnagar | 400/220kV Ghanapur – 220kV Hayatnagar DC U/G line/OH Multi ckt line |
| | | | | | | | | | | | | 132 KVSS Pattigadda 132 KVSS Gunrock | 132kV Pattigadda – 132kV Gunrock U/G DC line |
| | | | | | | | | | | | | 132KVSS Imlibun PTO (Miralam Filter Bed) GIS | 132kV Imlibun –PTO (Miralam Filter bed) U/G DC line |
| | | | | | | | | | | | | 220/132 KVSS Ghanapur | LIO of O/H 132kV Ghanapur Imlibun line to 132kV Moosarambagh GIS U/G SC line |
| | | | | | | | | | | | | 132 KVSS Narayanauguda 132 KVSS Fever Hospital | 132kV Narayanauguda – 132kV Fever Hospital U/G SC line |
| | | | | | | | | | | | | 132KVSS Fever Hospital 132KVSS Osmania University | 132kV Fever Hospital – 132kV Osmania University U/G DC line |
| | | | | | | | | | | | | Total Quantity | |
| | | | | | | | | | | | | | s e t |

| | | | |
|----|---|---|-----|
| 12 | 48V/200AH SMF VRLA Battery set | 0 0 0 0 0 0 1 0 1 0 0 0 0 0 1 0 0 1 0 0 1 0 0 1 0 0 5 | Nos |
| 13 | 6 pair PVC copper telephone Cable | 0. 0 2 0. 0 0. 0 1.6 | Km |
| 14 | single pair PVC copper telephone Cable | 0 0. 2 0. 0 0. 0 0. 0 1.6 | Km |
| 15 | 25 Sqmm Battery cable | 0 0. 2 0. 0 0. 0 0. 0 1.6 | Km |
| 16 | Optical Time Domain Reflector (OTDR) | 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 2 | Nos |
| 17 | Fusion Splicing Machine (FSM) along with standard accessories | 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 2 | Nos |
| 18 | Optical Power Meter | 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 2 | Nos |
| 19 | OFC tool kit consisting of Fibre stripping tool and tools for cutting and stripping of sheathing, jacket armouring of OFAC/ADSS/ OPGW cables including two binoculars | 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 2 | Nos |
| 20 | SDH STM4/16 Analyzer with Optical and Electrical Interfaces | 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 2 | Nos |
| 21 | 1.5 Ton Split type AC Units including 4 KVA Stabiliser | 0 2 0 2 1 1 0 1 0 1 0 1 0 2 0 0 0 1 0 0 1 1 1 1 0 0 15 | Nos |

DETAILS OF LINE EQUIPMENT LINKWISE

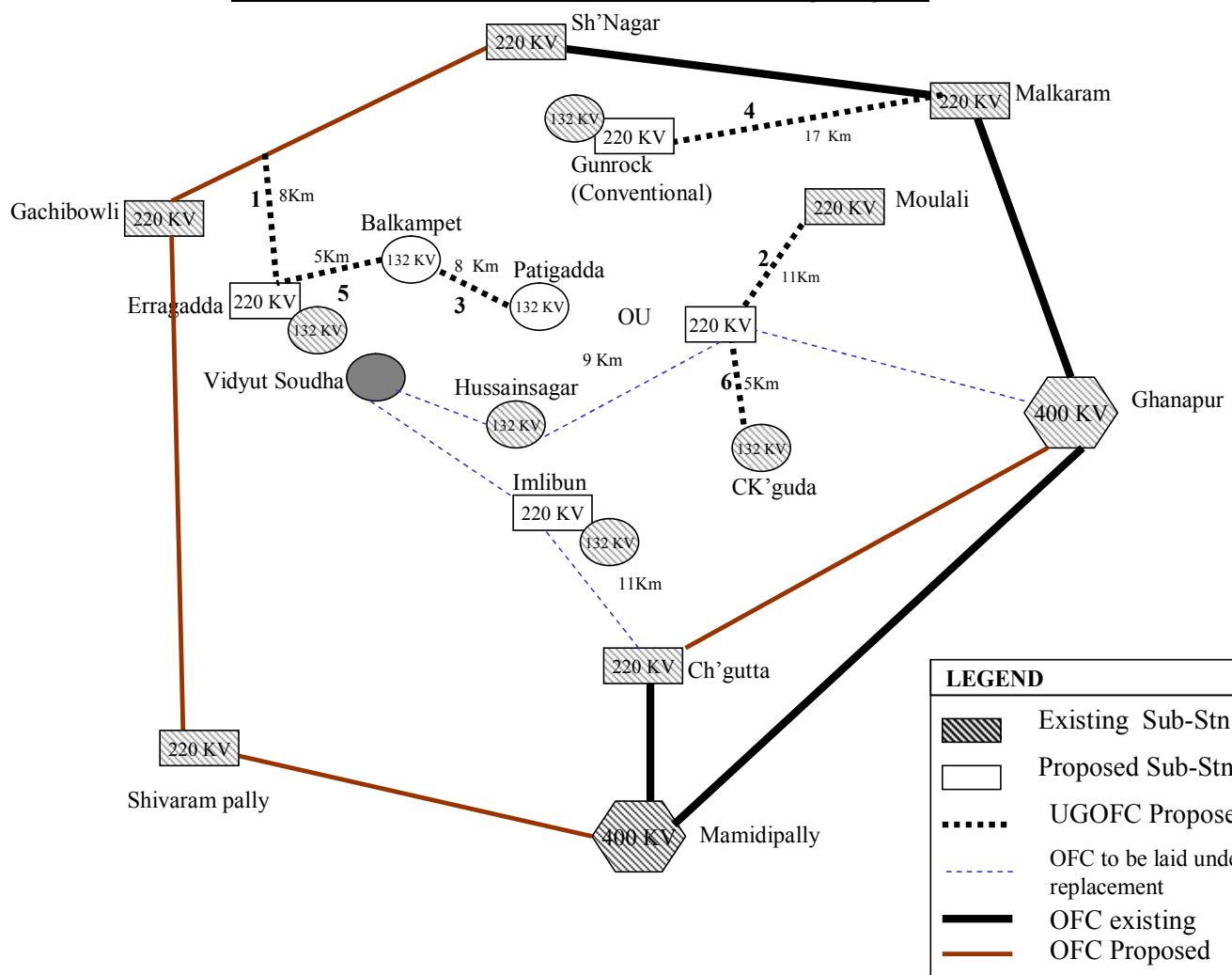
| | o n · s | Description of the Equipment | | | | | | | | | | | | Total Qty | UOM |
|---|--|------------------------------|----|---|---|--------|---|----------|----|----|----|-----|------|-----------|-----|
| | | Phase-I | | | | | | Phase-II | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | | |
| 1 | OPGW 24F of DWMSM type including sag, loop, Overheads @ 30% including all hardware accessories | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 0 | 57 | Km | | |
| 2 | Splice boxes (OPGW - OFAC) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | Nos. | | |
| 3 | Splice Boxes (OPGW - OPGW) | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 19 | Nos | | |
| 4 | Down Lead Clamps | 0 | 0 | 0 | 0 | 0 | 0 | 80 | 0 | 0 | 0 | 190 | Nos | | |
| 5 | O.F.Cable unarmoured 48 F DWMSM type (40F G 652D + 8F G- 655) (Cable portion taken 30% extra on Actual length) | 23 | 16 | 8 | 8 | 1 2 | 9 | 10 | 10 | 5 | 2 | 116 | km | | |
| 6 | Splice boxes 48 F U/G (Joint closures) | 8 | 6 | 4 | 4 | 5 | 4 | 5 | 5 | 3 | 3 | 54 | Nos. | | |

DETAILS OF SPARES LINE WISE

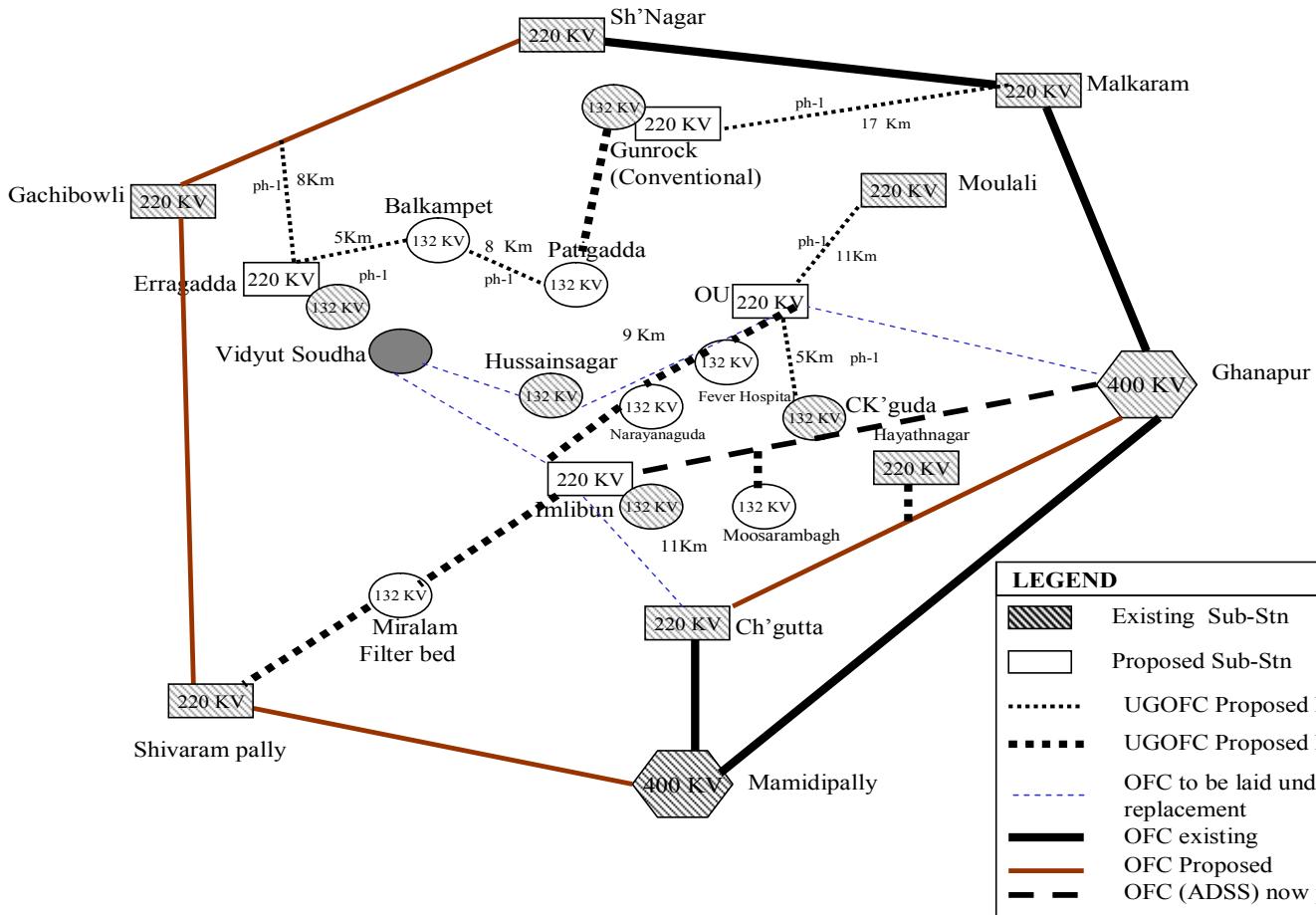
| S.No | Description of the Equipment | 400/220KV Ghanapur- 220 KV Hayatnagar DC U/G line/ OH Multi circuit line | LILO of O/H 132KV Ghanapur- Imlibun line to 132 Moosarambagh GIS U/G SC line | Total Qty | UOM |
|---|--|---|---|--------------|------|
| | | Qty | Qty | | |
| Spares of OFC (OPGW) Accessories | | | | | |
| 1 | Suspension Assembly for OPGW (Grounding clamps are part of suspension assembly) | 1 | 1 | 2 | Nos. |
| 2 | Tension Assembly for OPGW(Dead end Clamps and Grounding clamps are part of Tension Assembly) | 6 | 8 | 14 | Nos. |
| 3 | Vibration Dampers for OPGW | 14 | 18 | 32 | Nos. |
| 4 | Splice Boxes (OPGW - OPGW) | 1 | 1 | 2 | Nos. |
| 5 | Splice Boxes (OPGW - OFAC) | 1 | 1 | 2 | Nos. |
| 6 | Down Lead Clamps | 10 | 10 | 20 | Nos. |
| Spares of OLTE & Associated equipment: | | | | | |
| 7 | Mandatory Spare set for OLTE / MUX | 1 | 1 | 2 | Nos. |
| 8 | EPAX spare set | 1 | 1 | 2 | Nos. |
| 9 | Mandatory Spare set (One module for each type) for Digital Teleprotection | 1 | 1 | 2 | Nos. |
| 10 | Spare set of 48V/50A SMPS Float cum Boost Charger | 1 | 0 | 1 | No. |
| 11 | Spare set of 48V/35A SMPS Float cum Boost Charger | 0 | 1 | 1 | No. |

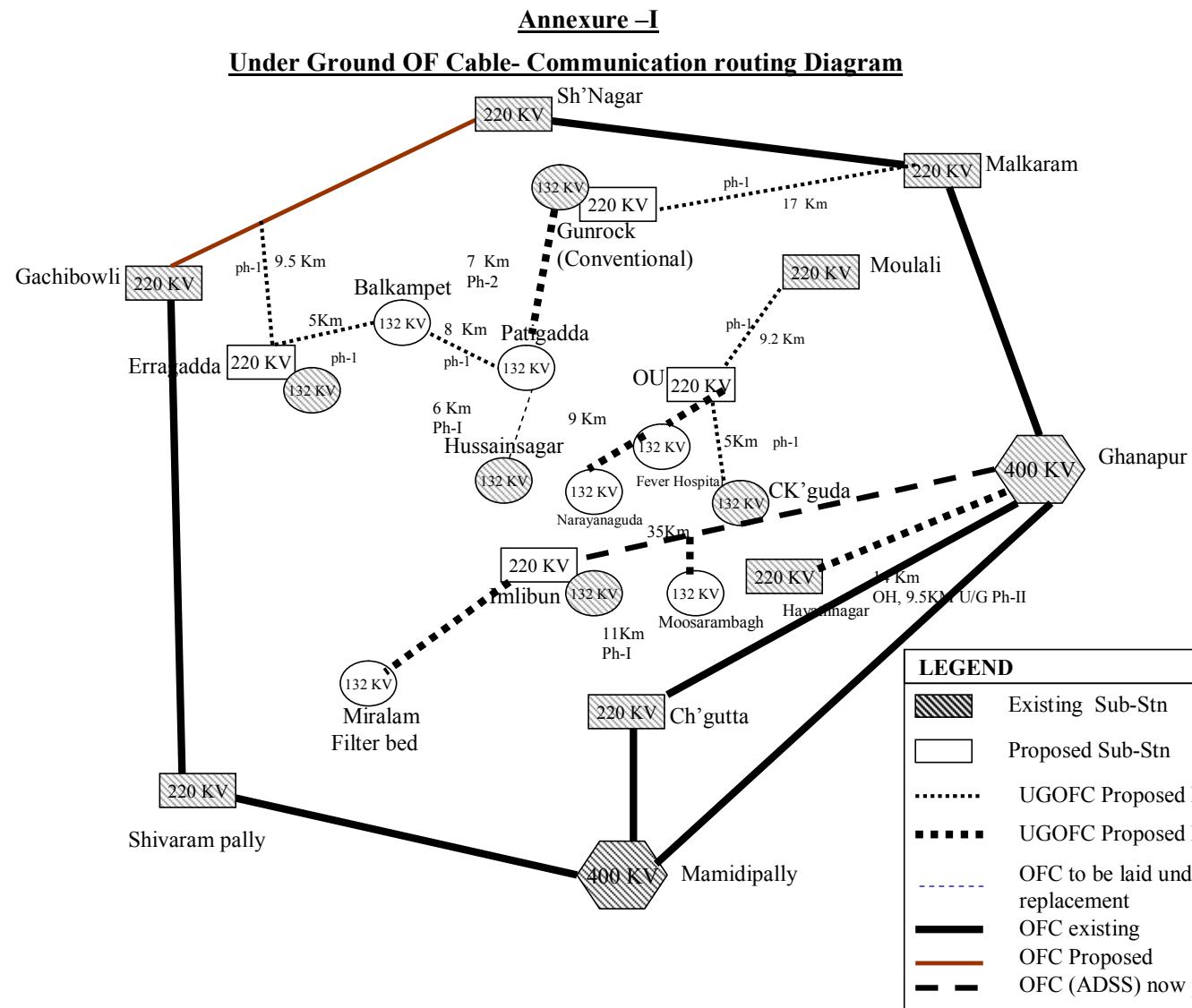
Annexure -I

Under Ground OF Cable- Communication routing Diagram



Annexure –I





SECTION - V

TECHNICAL SPECIFICATION FOR UNDER GROUND OFC , OPGW & ACCESSORIES , OLTE & ASSOCIATED EQUIPMENT

TECHNICAL SPECIFICATIONS FOR UNARMOURED UNDERGROUND FIBRE OPTIC CABLE

This section describes the functional requirements, major technical parameters and type testing and factory acceptance testing requirements for underground fibre optic cables. Marking, packaging and transportation requirements have also been described.

2.1 General

The underground fibre optic cable shall be an unarmoured cable suitable for underground installation in pipes. The cable should be of low weight, small volume and high flexibility. The mechanical design and construction of each unit shall be inherently robust and rigid under all condition of operation, adjustment, replacement, storage and transport.

2.2 Applicable standards

The following standards and codes shall be generally applicable to the equipment and works supplied under this contract:

- i) ITU-T/CCITT recommendations G.652 and G.655
- ii) Electronic Industries Association, EIA/TIA 455-78A, 455-3A, 455-62A, 455-164A/167A/174, 455-168A/169A/175A, 455-176, 455-59, EIA/TIA 598, EIA 455-104.
- iii) International Electrotechnical Commission Standards, IEC60304, IEC60794-1-2, IEC60811-5-1.
- iv) Bellcore Gr-20

2.3 Fibre Type(S) And Counts

The cable shall contain 48 nos. Of dual window single mode (DWDM) fibres conforming to G.652 and G. 655 as per the technical parameters stipulated in this document.

2.4 optical characteristics

The attenuation coefficient for wavelength between 1525nm and 1575nm shall not exceed the attenuation coefficient at 1550nm by more than 0.05db/km. The attenuation coefficient between 1285nm and 1330nm, shall not exceed the attenuation coefficient at 1310nm by more than 0.05db/km. The attenuation of the fibre shall be distributed uniformly throughout its length such that there are no point discontinuities in excess of 0.1db. The fibre attenuation characteristics specified in table 2-1 shall be “guaranteed” fibre attenuation of any & every fibre reel. Further the average cabled fibre attenuation, averaged over 100kms of cabled fibre, (as measured during the factory acceptance testing) shall be as specified in table 2-1.

Dwsm fibres shall conform to the requirements specified in table 2-1 below:

Table 2-1
Dwsm optical fibre characteristics

| G.652 | |
|-----------------------------|---|
| Fibre description: | Dual-window single-mode |
| Mode field diameter: | 8.6 to 9.5 μm ($\pm 10\%$ of the nominal value) |
| Cladding diameter: | 125.0 $\mu\text{m} \pm 2\mu\text{m}$ |

| | |
|--|---|
| Mode field concentricity error: | $\leq 1.0 \mu\text{m}$ |
| Cladding non-circularity | $\leq 2\%$ |
| Cable cut off wavelength: | $\leq 1260 \text{ nm}$ |
| 1550 loss performance | As per g.652 |
| Proof test level | $\geq 0.35 \text{ gpa}$ |
| Attenuation coefficient | @1310nm $\leq 0.35 \text{ db/km}$ @1550nm $\leq 0.23 \text{ db/km}$ |
| Attenuation at water peak (1383nm) | $\leq 2.1 \text{ db/km}$ |
| Chromatic dispersion; maximum: zero dispersion wavelength: zero dispersion slope: | 20 ps/(nm x km) @ 1550 nm 3.5 ps/(nm x km) @ 1288-1339nm 5.3 ps/(nm x km) @ 1271-1360nm 1300 to 1324nm -0.093 ps/(nm ² xkm) maximum |
| Polarization mode dispersion coefficient | $\leq 0.5 \text{ ps/km}^{1/2}$ |
| Temperature dependence: | Induced attenuation $\leq 0.05 \text{ db}$ (-60°C - +85°C) |
| Bend performance: | @1310nm (75+2 mm dia mandrel), 100 turns; Attenuation rise $\leq 0.05 \text{ db}$ @1550nm (75+2 mm dia mandrel), 100 turns; Attenuation rise $\leq 0.10 \text{ db}$ @1550nm (37+0.5 mm dia mandrel), 100 turn; Attenuation rise $\leq 0.50 \text{ db}$ |
| G.655 | |
| Fibre description: | Dual-window single-mode |
| Mode field diameter: | 8 to 11 μm ($\pm 10\%$ of the nominal value) @ 1550 nm |
| Cladding diameter: | 125.0 $\mu\text{m} \pm 2 \mu\text{m}$ |
| Mode field concentricity error: | $\leq 1.0 \mu\text{m}$ |
| Cladding non-circularity | $\leq 2\%$ |
| Cable cut off wavelength: | $\leq 1470 \text{ nm}$ |
| 1550 loss performance | As per g.655 |
| Proof test level | $\geq 0.7 \text{ gpa}$ |
| | @1310nm $\leq 0.40 \text{ db/km}$ @1550nm $\leq 0.25 \text{ db/km}$ @ 1383nm $\leq 1.0 \text{ db/km}$ |
| Chromatic dispersion; maximum: zero dispersion wavelength: zero dispersion slope: | >0.1 ps/(nm x km) @ 1440 nm 5.5 to 10 ps/(nm x km) @ 1530 – 1565 nm 7.5 to 13.4 ps/(nm x km) @ 1565-1625nm - 10.0 to -3.0 ps/(nm x km) @ 1285-1330nm <1440 nm 1550nm 0.052 ps/(nm ² xkm) maximum |
| Polarization mode dispersion | $\leq 0.5 \text{ ps/km}^{1/2}$ |

| | |
|--------------------------------|---|
| Temperature dependence: | Induced attenuation ≤ 0.05 db (-60°C - +85°C) |
| Bend performance: | @1310nm (75±2 mm dia mandrel), 100 turns; Attenuation rise ≤ 0.05 db @1550nm (75±2 mm dia mandrel), 100 turns; Attenuation rise ≤ 0.10 db @1550nm (37±0.5 mm dia mandrel), 1 turn; Attenuation rise ≤ 0.50 db |
| <u>End of table</u> | |

2.5 General construction

The optical cable shall consists of a central fibre optic unit protected by one or more layers of helically wound anti-hygroscopic tape or yarn. The central fibre optic unit shall be designed to house and protect the fibres from damage due to forces such as crushing, bending, twisting, tensile stresss and moisture, wide temperature variations, hydrogen evolution etc. The fibre shall be of loose tube construction. The inner polyethelene jackets shall be free from pin holes, joints splits or any other defects. All fibre optic cable shall have a minimum service life span of 25 years.

2.5.1 colour coding & fibre identification

Individual optical fibres within a fibre unit, and fibre units shall be identifiable in accordance with EIA/TIA 598 or iec 60304 or bellcore gr-20 colour-coding scheme. The colour coding system shall be discernible throughout the design life of the cable. Colouring utilized for colour coding optical fibres shall be integrated into the fibre coating and shall be homogenous. The colour shall not bleed from one fibre to another and shall not fade during fibre preparation for termination or splicing. Each cable shall have tracability of each fibre back to the original fibre manufacturer's fibre number and parameters of the fibre. If more than the specified number of fibres are included in any cable, the spare fibres shall be tested by the cable manufacturer and any defective fibre shall be suitably bundled, tagged, and identified at the factory by the vendor.

2.5.2 strength members

The central fibre optic unit should include a central strength member of fibre reinforced plastic (FRP) or other suitable material. Peripheral strength members and aramid yarns are also acceptable. The central frp strength member may be of slotted type with sz lay (reverse oscillation lay) of fibre units or it may be cylindrical type with helical lay of fibre units.

2.5.3 filling compound

The interstices of the central fibre optic unit and cable shall be filled with a suitable compound to prohibit any moisture ingress or any longitudinal water migration within the fibre optic unit or along the fibre optic cable. The water tightness of the cable shall meet or exceed the test performance criteria as per **iec60794-1-2-f5**. The filling compound used shall be a non-toxic homogenous waterproofing compound that is free of dirt and foreign matter, anti-hygroscopic, electrically nonconductive and non-nutritive to fungus. The compound shall also be fully compatible with all cable components it may come in contact with and shall inhibit the generation of hydrogen within the cable. The filling compound shall remain stable for ambient temperature up to +70°C and shall not drip, flow or leak with age or at change of temperature. Reference method to measure drip point shall be as per **iec 60811-5-1** and drip point shall not be less than 70°C.

2.5.4 The sheath / inner jacket

The sheath shall be black, smooth, concentric, and shall be free from holes, splits, blisters and other surface flaws. The sheath shall be extruded directly over the central fibre optic unit and shall also be non-hygroscopic. The cable sheath design shall permit easy removal without damage to the optical fibres or fibre units. The sheath shall be made from good quality of weather resistant polyethylene compound (black high density polyethylene- HDPE) and thickness shall be $\geq 1.8\text{mm}$.

2.5.5 the outer jacket / termite protection.

A circular jacket of not less than 0.65 mm polymide-12 (orange nylon-12) material should be applied over the sheath as an outer jacket. The outer jacket shall have smooth finish and shall be termite resistant.

2.5.6 rip cord: suitable rip cord(s) shall be provided which shall be used to open the sheath(s) and the armour of the cable. The rip cord(s) shall be properly waxed to prevent wicking action and shall not work as a water carrier.

2.6 mechanical parameters & tests

(a) **tensile strength:** the cable shall be of sufficient strength to withstand a load of value $t(n)=9.81\times 2.5\times w$ newton or 2670n which ever is higher(where w is the mass of 1km cable in kg). The load shall be sustained for 10 minutes and the strain of the fibre monitored. The load shall not produce a strain exceeding 0.25% in the fibre and shall not cause any permanent damage to any constituent part of the cable. The change in optical attenuation during or after the application of the rated tensile load in accordance with **iec60794-1-2-e1** procedure shall not exceed 0.05db/km both for 1310nm and 1550nm wavelength. The attenuation shall be noted before strain, during strain and after release of strain for all the fibres.

(b) **crush test (compressive strength):** the cable shall withstand a compressive force of at least 4000 n, applied for at least 60 seconds between two plates of 100mm x 100mm in accordance with iec60794-1-2-e3 procedure. This compressive load applied in accordance with **iec60794-1-2-e3** shall not cause any permanent damage to any constituent part of the cable. The change in optical attenuation during or after the application of the compressive load shall not exceed 0.05db both for 1310nm and 1550nm wavelength. The attenuation shall be noted before, during and after the test for all fibres.

(c) **bend radius:** the cable bend radius under no load shall be less than or equal to 20 times the cable diameter. The test method shall be according to the iec60794-1-2-e11 (procedure-1). The fibres and component parts of the cable shall not suffer permanent damage when the cable is subjected to 10 cycles of wrapping and unwrapping of 4 complete turns around a mandrel of dia equal to 20 times the cable diameter. The change in optical attenuation after the test shall not exceed 0.05db both for 1310nm and 1550nm wavelength. The attenuation shall be noted before and after the test for all fibres. Outer jacket shall not show any cracks visible to the naked eye when examined whilst still wrapped on the mandrel.

(D) **Cable bending test (repeated bending):** the cable shall withstand repeated bending when tested in accordance with eia-455-104 and shall not cause any permanent damage to any constituent part of the cable. The cable sample shall be at least 5 meters or more. The change in optical attenuation during or after the application of the repeated bending test shall not exceed 0.05db. The attenuation shall be noted before and after the test for all the fibres. The test requirement shall be as mentioned below: -

| | |
|---|---------------------------|
| weight | 5kg |
| minimum distance from pulley centre to holding device | 216mm |
| minimum distance from weight to pulley centre | 457mm |
| pulley diameter | 20 times to the cable dia |
| angle of turning | 90° |
| number of cycles | 30 |
| time required for 30 cycles | 2 min. |

- (E) **Impact test:** the cable shall withstand at least 10 impacts of 50n load from a 0.5 metre height with impacting surface radius of 12.5mm. The 10 impacts when applied at the same place in accordance with **iec60794-1-2-e4** shall not cause any permanent damage to any constituent part of the cable. The change in optical attenuation during or after the application of the impact load shall not exceed 0.05db.the attenuation shall be noted before, during and after the test for all fibres.
- (f) **torsion test:** the cable shall withstand 10 cycles of $\pm 180^\circ$ torsion with 400n load applied on a 2m sample. This load cycle applied in accordance with **iec60794-1-2-e7** shall not cause any permanent damage to any constituent part of the cable. The change in optical attenuation during or after the application of the torsion load shall not exceed 0.05db for all fibres. The attenuation shall be noted before, during and after the test.
- (g) **kink test (resistance):** when a cable of sample length 10 times the minimum bend radius as defined above is subjected to kinking, it shall not result in any fibre breakage and the kink shall disappear after normalising the cable. The change in optical attenuation after the application of the kink in accordance with **iec60794-1-2-e10** shall not exceed 0.05db for all the fibres.
- (h) **water ingress test (resistance to water penetration):** the water ingress test of the cable shall meet or exceed the test performance criteria as per **iec60794-1-2-f5** method b. Before applying the water tight seal at one end the outer jacket shall be stripped. A water-soluble fluorescent dye shall be used for testing. The duration of test shall be 24 hours. In addition after the test the cable shall be ripped open and the distance up to which water has seeped shall be noted.
- (I) **Drip test (seepage of filling compound):** For testing, a sample of 30 cm length of the cable with one end sealed by the end cap will be taken and outer jacket, sheath, binder tapes shall be removed by 5cms from open end of the sample. The filling compound will be wiped thoroughly and the sample be kept vertically with open end down ward in the oven for 24 hours at 70°C temperature with a filter paper under the sample. The filter paper should not indicate any sign of drip or oily impression. The reference test specification shall be as per **iec60811-5-1** to measure drip point.
- (J) **Environmental test:** temperature cycling test shall be carried out on one drum length of the cable to ensure stability of attenuation parameter of the cable when subjected to temperature change which may occur during storage, transportation, and operation. The permissible temperature range for storage and operation will be from -20°C to $+70^\circ\text{C}$. The rate of change of temperature during test shall be 1°C per minute. The cable shall be kept for 12 hours at each of the following temperature and should follow the specification **iec60794-1-2-f1**. Two cycles shall be performed.
- | | |
|-----|-----------------------|
| ta2 | : -20°C |
| ta1 | : -10°C |
| tb1 | : $+60^\circ\text{C}$ |
| tb2 | : $+70^\circ\text{C}$ |
- the attenuation shall be measured at the end of each temperature range both at 1310nm & 1550nm.the change of attenuation of the fibre used shall be $\leq 0.05 \text{ db/km}$ for 1310 & 1550nm for entire range of temperature for all the fibres in each cycle.
- (K) Termite resistance test: 3 (three) samples of optical fibre cables of 2(two) meter length each shall be taken from the selected drums for optical fibre cable and the ends shall be sealed with metallic caps. These test samples will be sent to the reputed test lab for termite resistance test. The test procedure and period shall be as per cazri, jodhpur. All samples shall be checked for any termite attack over the nylone-12 jacket. The outer jacket shall be demonstrated to be termite resistant. Attack by termites shall be

disregarded but termite should not penetrate or damage the nylone-12 jacket of any sample. Observation on any damage of the cable shall be recorded.

- (L) **Abrasion test:** to be conducted as per iec 60794-1-e2 or equivalent international test method.
- (M) **Flexure rigidity test:** to be conducted as per astm d-790. The test shall not cause any permanent damage to any constituent part of the cable. The change in optical attenuation after the test shall not exceed 0.05db/km. The attenuation shall be noted before and after the test for all the fibres.
- (N) **Figure of eight test:** 1000m of cable shall be uncoiled from the drum and arranged in figure of eight, each loop having a maximum dimension of 2m. It shall be possible to arrange cable in figure of 8 with relative ease and the cable shall not show any visible damages.
- (O) **Cable ageing test:** after environmental test the cable shall be subjected to a temperature of 85 ±2 °c for 168 hours. Cable shall then be brought to ambient temperature and stabilised for 24 hours. The change in optical attenuation after the test shall not exceed 0.05db/km for 1310 as well as 1550 nm wavelengths. The attenuation shall be noted before and after the test for all the fibres.
- (P) **Embrittlement test of loose tube:** the minimum length of the test sample depends of the outside diameter of the loose tube and should be 85mm for tubes upto 2.5mm outside dia. The length of the bigger tubes should be calculated by using the following equation :

$$l_0 > 100 \times ((d^2 + D^2)/4)^{1/2}$$

where

l_0 = length of tube under test

d = outside dia of loose tube.

D = inside dia of loose tube.

both the ends of a buffer tube test sample may be mounted in a tool which is clamped in jaws of a tensile machine which exert a constant rate of movement. The movable jaw may move at a rate of 50 mm per minute toward the fixed jaw. Under load the tube will bend, so that the tube is subjected to tensile and compressive stresses. The fixture for holding the tube should be designed in a manner that the tube might bend in all directions without further loading. The tube should not get embrittled. No ink should appear on the tube upto the safe bend dia of tube (20 d) where d is the outside diameter of the loose tube. There should not be any physical damage or mark on the tube surface.

- (Q) **Kink resistance test on the loose tube:** a longer length of the loose tube is taken (with fibre and gel), a loop is made and loop is reduced to the minimum bend radius of loose tube i.e. 20 d . (where d is the outside dia of the loose tube). This test is to be repeated 4 times on the same sample length of the loose tube. No damage or kink should appear on the surface of the tube.
- (R) **Drainage test for loose tube:** a tube length to 40 cm shall be cut and filled with filling gel ensuring there are no air bubbles and the tube is completely full. The filled tube is placed in a horizontal position on a clean worktop and cut 5 cm from each end so that the finished length of the sample is 30 cm. The filled tube shall be left in a horizontal position at an ambient temperature for 24 hrs. The sample tube is then suspended vertically in an environment heat oven over a weighed beaker. It is left in the oven at a temperature of 70 °c for a period of 24 hrs. At the end of the 24 hrs. Period the beaker is checked and weighed to see if there is any gel in the beaker. There shall be no gel or oil in the beaker.
- (S) **Check of easy removal of sheath :** the sheath shall be cut in circular way using a sheath removal tool and the about 300 mm length of the sheath should be removed in one operation.

It should be observed during sheath removal process that no undue extra force is applied and no component part of the cable is damaged. It shall be possible to remove the sheath easily. Easy removal of both the outer jacket and the inner sheath shall be checked separately.

- (T) **Effect of aggressive media on the cable surface (acidic and alkaline behaviour)** the test shall be conducted as per method no. Iso175. The two test samples of the finished cable each of 600 mm in length are taken and the ends of the samples shall be sealed. These test samples are put in the ph4 and ph10 solutions separately. After 30 days these samples are taken out from the solutions and examined for any corrosion etc. On the sheath and other markings of the cables. The sample should not show any effect of these solutions on the sheath and other marking of the cable.

2.7 cable drums, marking, packaging and transport

All optical fibre cable shall be supplied on strong wooden drums provided with lagging with adequate strength, constructed to protect the cabling against all damage and displacement during transit, storage and subsequent handling during installation. **However, the exact lengths for drums to be supplied for each section of the link shall be determined by the contractor during survey. Drum schedule shall be approved by the employer before manufacturing the fo cable.** Both cable ends in the drum shall be sealed and shall be readily accessible. The drum shall be marked with arrows to indicate the direction of rotation. Both the ends of the cable shall be provided with pulling eye. The pulling eye and its coupling system should withstand the same tensile load as applicable to the cable. The following marking shall be done on each side of the cable drums.

- I) Drum number
- II) Consignee's name and address
- III) Contractor's name and address
- IV) Type of cable
- V) Number of fibres
- VI) Type of fibres
- VII) Year of manufacturing, month & batch no
- VIII) Name of manufacturer
- IX) Total cable length
- X) Inner end marking and outer end marking

Packing list supplied with each drum shall have all the information provided on marking on the respective cable drum and following additional information: otdr length measurement of each fibre and ratio of fibre and cable length.

2.7.1 optical fibre cable marking

A suitable marking shall be applied in order to identify this cable from other cables. Marking on the cable shall be indelible, of durable quality, shall last long and shall be applied at regular interval of one-meter length. Marking shall be imprinted and must clearly contrast with the surface and colors used must withstand the environmental influences experienced in the field. The accuracy of the sequential marking must be within $\pm 0.5\%$ of the actual measured length. The sequential length marking must not rub off during normal installation. In case laser printing is used the marking shall not exceed 0.15 mm depth. The optical fibre cable shall have the following markings in every meter.

- I) Type of cable
- II) Running meter length
- III) Number of fibres
- IV) Type of fibre
- V) Laser symbol & caution notice

VI) Year of manufacture and batch no.

VII) Manufacturer's name

VIII) Aptransco

2.7.2 operating instructions

Complete technical literature in english with detailed cable construction diagram of various sub-component with dimensions and test data of the cable shall be provided. All aspects of installation shall also be covered in the handbook.

2.8 test and inspection:

From each batch of cables presented by the contractor for factory acceptance testing, the employer shall select random sample(s), to be tested for acceptance. The sampling rate for the factory acceptance tests shall be 10% of the batch size (minimum 2) for fo cable drums-

In case any of the selected samples fail, the failed sample is rejected and additional 20% samples shall be selected randomly and tested. In case any sample from the additional 20% also fails the entire batch may be rejected.

Since fat testing provides a measure of assurance that the quality control objectives are being met during all phases of production, the employer reserves the right to require the contractor to investigate and report on the cause of fat failures and to suspend further testing/ approvals until such a report is made and remedial actions taken, as applicable.

2.8.1 type testing.

The tests listed in table 2.2 shall be carried out as type tests for fibres.

table 2.2 type tests for optical fibres

| S.no. | Test name | Acceptance criteria | Test procedure |
|--------------|---------------------------------------|---------------------|------------------------------|
| 1 | Attenuation | Ts table 2-1 | Eia/tia 455 – 78a |
| 2 | Attenuation variation with wavelength | Ts table 2-1 | Eia/tia 455 – 78a |
| 3 | Attenuation at water peak | Ts table 2-1 | Eia/tia 455 – 78a |
| 4 | Temp.cycling | | Eia/tia 455 – 3a, 2 cycles |
| 5 | Attenuation with bending | Acceptance criteria | Eia/tia 455 – 62a |
| 6 | Mode field dia | | Eia/tia 455 – 164a/167a/174 |
| 7 | Chromatic dispersion | | Eia/tia 455 – 168a/169a/175a |
| 8 | Cladding diametre | | Eia/tia 455 – 176 |
| 9 | Point discontinuities of attenuation | | Eia/tia 455 – 59 |
| 10 | Core – clad connectivity error | | Eia/tia 455 – 176 |
| End of table | | | |

The cable to be supplied should have been type tested as per relevant tec specification including latest amendment. The bidder shall submit along with their bid earlier carried out type test reports as per tec specification (mandatory requirement) for the offered fibre optic cable.

2.8.2 factory acceptance testing

The tests listed in table 2-2 shall be carried out as factory acceptance test for underground fibre optic cable meeting the requirements specified in this section. However, for water ingress test and environmental test, previous test reports for similar type of test conducted by any reputed/government organisation shall be submitted instead of performing these tests.

Table 2-3
factory acceptance tests on underground fibre optic cable

| S. No. | Factory acceptance test |
|--------|---|
| 1 | Attenuation coefficient (1310, 1550): by eia/tia 455- 78a or otdr |
| 2 | Point discontinuities of attenuation: by eia/tia 455- 78a or otdr |
| 3 | Visual material verification and dimensional checks as per tec specification. |
| 4 | Water ingress test - previous test report for similar type of test conducted by any reputed/ government organisation shall be submitted. |
| 5 | Tensile strength test / strain test |
| 6 | Impact test |
| 7 | Kink test |
| 8 | Environmental test - previous test report for similar type of test conducted by any reputed/ government organisation shall be submitted. |
| 9 | Crush test |
| 10 | Drip test |

Specification for optical fibre joint box

This specification gives the general requirements, type and factory testing requirements of joint box for optical fibre cables. The packaging and transportation requirements have also been specified.

The joint box should be suitable for use in manholes as well as direct buried applications. It shall also be possible to branch out the cable from the joint box as and when required without damaging the existing cables. The joint box shall have minimum 4 single cable entry ports and one oval port (60x40mm) having sealed designed such that it will be opened by cutting only as and when required. All materials used for joint box and sealing shall be termite resistant.

3.1 construction of joint box

The joint box shall be manufactured as per the latest state of art technology. The design of the joint box must ensure:

- (I) Mechanical and optical protection of the fibre.
- (II) Environmental protection of the splice.
- (III)The integrity of the connections and cable seals, fibres and buffers during mounting, functioning and dismounting.
- (IV)The possibility of the repeated reopening and re-closing of the joint box and fibre organizer without removing or modifying the joint box but only by replacing the sealing.
- (V) The addition of new cables shall be possible in the same joint box, if required.

(VI)It shall be possible to terminate all cables having outer diameter from 8mm to 18mm.

(VII)The size of the joint box shall be minimum 450mm x 135mm (height x dia.).

(VIII)The size of fibre organizer cassette shall be \geq 300mm x 95mm (length x width).

The joint box shall be complete in all respect and shall consist of following main parts:

3.1.1 main box

The main box shall be sturdy, durable box having a base and dome shaped body. The dome shall be fixed on the base. The domed shaped body shall cover the entire junction while the base shall enable the entries of the optical fibre cable. The base and dome shall be made of thermoplastic/high density polypropylene material. The joint box should be suitable for opening and reentry frequently without impairing its properties. The body may have ribs as strength member if required.

3.1.2 cable organizer (strength member and cable termination)

Cable organizer shall be suitable to secure extra length of fibre tubes with safe bending radius. It should not cause any strain or tension on the fibre. It shall be possible to fix the strength member(s) and the optical fibre cable firmly so that the cable arrangement will not shift or move laterally inside the joint box. The internal structure shall be metallic (made of stainless steel) to support and hold the cables and strength members etc. The metallic parts for making connections shall be made of brass or nickle chromium plated steel and the total assembly shall be corrosion proof.

3.1.3 fibre organiser/ fibre splice trays

Fibre organiser shall be non-metallic made of abs material having following characteristic.

| | | |
|-----------------------|---------------------------|--------------|
| (i) specific gravity | 1.01-1.21 gm/cc | astm-d-792 |
| (ii)tensile strength | 0.002kg/sqmm - 0.005kg/mm | astm-d-638 |
| (iii)elongation | <50% | astm-d-638 |
| (iv)water absorption | 0.3-0.4 | astm-d-57-59 |
| (v)rock well hardness | r81-r111 | astm-d785a |

Contractor shall furnish test certificates in conformity to the above parameters of the abs material. Fibre organiser cassettes shall be provided on which the fibre splice and service loops of fibres may be placed by making fibre coils. Slots on the splice tray for fixing splice protection sleeve shall be in such a way that they will not cause any stress or strain on sleeve or fibre and shall not shift, loose or move inside the tray or come into conflict with the fibre coils once fixed. It shall be possible to fix a minimum of 4 secondary tubes at the entry port of each tray. No pvc or any other type of adhesive tape is permitted to hold fibres and loose tube inside the tray. To the extent possible all fibres of a tube shall be spliced in a single tray for better tube identity and fibre looping. In case it is not possible to splice all fibres of a tube in a single tray, the remaining fibres of the tube shall be looped back to the adjacent tray with transport tube supplied with joint box. The quantity of splice trays in the joint box shall be as per the number of fibres in a particular cable as mentioned below:

| Type of cable | splice trays (fibre organiser) | fibre splices/tray |
|---------------|--------------------------------|--------------------|
| 48 fibre | 4x2=8 | 6 |

The fibre organiser shall be fixed inside the joint box in such a way that this shall not loosen once fixed or to shift or move in any way.

3.1.4 Holding arrangements

The box shall provide the following:

- (I) Holding arrangement and framework for properly securing cable organizers with splice trays.
- (II) Securing arrangement for holding fibres.
- (III) Holding device to hold strength member of fibre optic cable securely.
- (IV) Any other extra component required for providing strength and reliability to the joint box.

3.1.5 compatibility

All the component and parts used shall be compatible with the optical fibre cable, fibre splices and cable components. Their use for long should not result in increase in transmission loss or deterioration in other properties.

3.1.6 marking on body of the joint box

The following information by marking on joint box shall be provided:

- (I) Manufacturer's name & date
- (II) Type of joint box
- (III) Number of splice organiser cassettes
- (IV) Number of splices per cassette
- (V) Batch number and serial number.

3.2 general

The joint box shall confirm to the itu-t standards or latest standards prescribed by tec.
Other important requirements are as follows.

- (I) Assembly: - the method of assembly, box and reopening shall be simple and adoptable with minimum training.
- (II) Component:- all component shall be durable and of good quality. Number of component should be minimum and adequate.
- (III) Consumables:- consumables mentioned in table 3.1 or any other items required shall form a part of joint box.
- (IV) Capacity of joint box:- the joint box shall be suitable for splicing for 24 fibre cables. Suitable joint box shall be provided to encase the optic cable splices in a protective, moisture and dust free environment. The joint box shall be designed for the storage and protection of a minimum of 24 optical fibre splices and equipped with sufficient number of splice trays for splicing all fibre in the cable. If and when required the capacity of joint box can be increased by adding extra splice trays only.

3.3.1 joint box installation

Installation and sealing of joint box shall be done according to the instruction manual provided with joint box. The following general criteria must be fulfilled.

- (I) Fibre loose tubes shall be placed safely inside the joint box and routed properly.
- (II) Sheath shall be fully inside the joint box and FRP shall be properly fixed.
- (III) Silica gel shall be placed inside the joint box before closing the box.
- (IV) The sealing portion of the cable and joint box shall be filled before placing heat shrinkable sleeves. Rubber gaskets may be placed according to the instruction manual, if any.

- (V) The heat shrinkable sleeves shall be sealed with very low flame of hot gun till sealing liquid properly melt and gripped. The cable entry ports being used for cable entry into the joint box shall be sealed by heat shrink sleeves only for ease of installation and reentry. The length of the sleeve shall cover the full length of the cable entry port and at least 30mm length of the cable. Heat shrink tube shall have wall thickness of at least 1.5mm before shrinkage and ≥ 2.5 mm after recovery. For sealing of base with dome, contractor may use mechanical sealing or heat shrink sleeve system. In case of mechanical sealing contractor shall indicate the exact method. The gasket or the "o" ring required for sealing shall be made of neoprene rubber and after sealing it shall be air-tight.
- (VI) The joint box shall be housed inside the manhole horizontally or vertically by suitable means.

3.4 tests and inspection:

3.5 type tests:

The joint box offered for supply shall have been type tested as per tec specification (mandatory). The bidder shall submit along with their bid the earlier carried out type test reports as per tec specification.

3.6 factory acceptance tests

Factory acceptance test shall be waived off, if the joint box offered for supply meets the requirement as stated in section- 3.4 and section 3.5.

3.7 packing and transportation:

The joint box shall be transported after proper packing including the list of all sub-component, required maintenance spares. Consumables, mentioned in table 3.1 shall be supplied along with each joint box. Each joint box shall be fully packed with all its components. All tools and accessories should be properly packed with each joint box and the joint box packets should be placed inside an adequate size container for good looking packing and safe transportation.

**Table 3.1
List of consumables required with joint box**

| S.no | Item | Qty. |
|------|--|---|
| 1 | Protection sleeves For example, for 24 fibre joint box, protection sleeves shall be 36. | As per the fibre count in the cable + 50% extra quantity |
| 2 | Cable tie | 24 numbers of required length |
| 3 | Tissue/lens paper 3"x4" | 100 numbers |
| 4 | Acetone (lab grade) | 100 ml |
| 5 | Hexane (lab grade) | 100 ml |
| 6 | Isopropyl (lab grade) | 100 ml |
| 7 | Pvc adhesive tape (5meter length of 10mm width) | 1 number |
| 8 | Double side adhesive tape | 1 number |
| 9 | Sealing arrangement | 1+1 (one complete set to be supplied as a spare) for all sealing ports. |
| 10 | Cable and fibre identification rings | 2 sets |
| 11 | Transport tube | As per the requirements |
| 12 | Gasket or o-ring (in case of mechanical sealing) | 1+1 (one o-ring to be supplied as a spare |
| 13 | Any other item | As per the requirements |

End of table

4.1 installation of the unarmoured underground optic fibre cable

The cable shall be installed inside HDPE green duct already installed earlier. The cable shall be installed by compressed air blowing technique. The cable blowing machine shall be capable of blowing the fibre optic cable length of at least 1 km or more. It shall be possible to blow more than **8 km** per day using the blowing machine. The contractor shall propose the exact methods and procedures for installation taking into consideration the following guidelines for approval by the employer.

- A. The optical fibre cable drums shall be handled with utmost care. The drum shall not be subjected to shocks by dropping etc. They shall not be normally rolled along the ground for long distance and when rolled, shall in the direction indicated by the arrow. The battens shall be removed only at the time of actual laying.
- B. A blowing machine in association with an appropriate compressor shall be used for blowing.
- C. Temporary blowing chambers (if required) shall be constructed and then backfilled after blowing operation is completed.
- D. Locations along the route, which provide easy access points for blowing machine and compressor, shall be determined.
- E. Before starting the cable blowing, both HDPE pipes installed under this package shall be checked for obstacles or damage. The already installed HDPE pipe wherein cable are to be installed under this package shall also be checked for obstacles or damage. Checking shall be done by using a proper sized mandrel equipped with a transmitting device.
- F. Always blow downhill wherever possible.
- G. Multiple blowing machines may be used in tandem if so required.

Installation by pulling may be permitted by the employer only in specific cases where installation by blowing is not feasible. In case pulling is used, the pulling speed shall be determined considering the site condition. Care must be taken not to violate the minimum bending radius applicable for the fibre optic cable. Tension in the cable during laying shall not exceed tension limit given in section 1 and the cable should not be damaged during or after the pulling.

While installing the cable, excess length of about 10 meters shall be stored at each joint location for each side. Excess length of 10 m shall be kept at one ends of a road crossing, culvert crossing and 20 meters at one end of bridges, however, exact excess lengths and manhole locations shall be finalised during detailed engineering. The excess length shall be housed in manholes.

Before undertaking the blowing activity, the spare duct shall be inspected for any damage and in case, the damage is noticed, it has to be rectified. The rectification work shall be in the scope of the contractor including **civil work**, without any additional cost to APTRANSCO. The **duct integration test** shall be conducted as per APTRANSCO approved norms and practices, before taking up the blowing activity.

4.2 installation of joint box.

The joint box shall be properly installed, assembled and sealed as detailed in section 3. The joint box shall be vertically installed on the wall of man hole using suitable fixtures.

4.3 optical fibre splices

Splicing of the optical fibre cabling shall be minimized through careful planning. All works of splicing shall be carried out inside an air conditioned environment. It is important that all splicing work be done under very clean conditions and under controlled temperature as it contributes to the quality of the splice and prevents building of temperature-dependent fibre tension into the splice. All required splices shall be planned to occur at joint location/manhole. All optical fibre splicing shall comply with the following:

1. All fibre splices shall be accomplished through fusion splicing.
2. Each fibre splice shall be fitted with a splice protection sheath fitted over the final splice.
3. All splices and bare fibre shall be neatly installed in covered splice trays. Normally 6 splices shall be installed in a tray.
4. For splicing of each fibre, every effort shall be made to minimise the bi-directional average splice loss. It is recommended that during splicing, on-line splice loss testing shall be carried out by a team with OTDR from open ends on both sides. The splicing team shall work in conjunction with the testing teams for on-line correction/rectifications of the splices.
5. Average bi-directional splice loss at any particular splice shall not exceed 0.1db but total bi-directional average of all splices in a link shall not exceed 0.05db.
6. Fibre optic cable service loops as indicated in section 4.4 service loops shall be provided.

4.4 service loops.

For purposes of this specification, cable and fibre service loops are defined as slack (excess) cable and fibre provided for facilitating the installation, maintenance and repair of the optical fibre cable system.

A. Outdoor cable service loops: at manhole chambers splices are installed with sufficient fibre optic cable service loops (as provided in section 4.1) such that the recommended minimum bend radius is maintained while allowing for installation or maintenance of the cable to be performed in a controlled environment at ground level. Optical cable service loops (excess cable) shall also be provided at all crossings in manholes (as provided in section 4.1).

B. Fibre units service loops: for all fibre optic cable splicing, the cable shall be stripped back a sufficient length such that the fan-out of fibre units shall provide for at least one (1) metre of fibre unit service loop between the stripped cable and the bare fibre fan-out.

C. FIBRE SERVICE LOOPS: At least 0.5 metre of bare fibre service loop shall be provided on each side of all fibre splices. The bare fibre service loops shall be neatly and safely installed inside covered splice trays.

4.5 SITE ACCEPTANCE TESTING (SAT) FOR UNDERGROUND FIBRE OPTIC CABLE

Sat for optical fibre cable shall be carried out link by link from permanent manhole to permanent manhole.

Prior to installation, every spooled fibre optic cable segment shall be tested for compliance with the pre-shipment data previously received from the manufacturer. This requirement will preclude the installation of cable segments that may have been damaged during shipment. Test requirements are as per table 4-1.

Optical fibre attenuation shall be measured after installation and before splicing. Any increase in attenuation or step discontinuity in attenuation shall not be acceptable and shall constitute a cable failure. The contractor shall have to either replace the concerned cable span at its own cost or provide additional splicing, joint box and manholes required to rectify the fault at its own cost. The fibre attenuation shall be tested again after replacement or rectification of fault.

During the installation, spliced cable segments shall be tested and documented. In case it is found that the splices are bad (loss is unacceptable as per approved test procedures), the contractor shall have to do re-splicing and provide new joint box wherever required at no additional cost to the employer. After re-splicing the end to end testing shall be repeated. The splice testing requirements are indicated in table 4-2.

Upon completion of a continuous cable path, all fibres within the cable path shall be demonstrated for acceptance of the cable path. Test requirements are indicated in table 4-3 and in no case losses attributed due to other factors viz. Extra splice, kinks, will be acceptable to the limit determine by the following formula:

Max attenuation @ 1550nm: $0.23\text{db}/\text{km} + 0.05\text{db} \times \text{total no of splices} + 0.5\text{db} \times \text{connector}$

Max attenuation @ 1310nm: $0.35\text{db}/\text{km} + 0.05\text{db} \times \text{total no of splices} + 0.5\text{db} \times \text{connector}$

As averaged over 100 km of fibre.

**Table 4-1:
Fibre optic cable pre-installation testing**

| Item: | Description: |
|-------|---|
| 1. | Physical inspection of the cable assembly for damage |
| 2. | Optical fibre continuity and fibre attenuation with OTDR at 1550 nm |

**Table 4-2:
Fibre optic cable splice testing**

| Item: | Description: |
|-------|--|
| 1. | Per splice attenuation with otdr (bi-directional average) |
| 2. | Physical inspection of joint box for proper fibre routing techniques |
| 3. | Physical inspection of sealing techniques, weatherproofing, etc. |

**Table 4-3:
Fibre optic cable commissioning testing**

| Item: | Description: |
|-------|--|
| 1. | Fibre continuity and link attenuation (bi-directional) between fodp connectors at two ends for each fibre at 1310 &1550 nm by otdr |
| 2. | Fibre continuity and link attenuation (bi-directional) between fodp connectors at two ends for each fibre at 1310 &1550 nm by power meter & laser source |
| 3. | Average splice loss (bi-directional) for each splices and average splice loss for the link by otdr at 1550 nm as per section 4.11.4. |

-end of table-

4.5.1 SAT for joint box

20% joint box shall be tested for water penetration. Installed joint box shall be completely immersed in water for 1 hour under 1 meter head, then opened and observed for water/moisture ingress. The joint box shall then be sealed and installed again. In case any water/moisture is detected, test shall be declared failed and all the joint boxes shall be tested, all failed joint boxes shall have to be re spliced and resealed.

4.6 Interconnection

The contractor shall interconnect their fibre optic cable system at both ends with existing underground Fibre optic and/or OPGW system through splicing in joint boxes or through connection by patch cords at permanent manholes/ FODPS, as required.

TECHNICAL SPECIFICATION FOR OPTICAL LINE TERMINAL EQUIPMENT AND MUX

SECTION -I

1.0 GENERAL

It is intended to provide a communication and protection system for 220 KV GIS Substations:

- a) 220KV SS Malkaram to 220 KVSS Gunrock (23KM)
- b) 220 KVSS Chandrayangutta to 220 KVSS Imlibun (16KM)
- c) 220/ 132 KVSS Osmania University to 132/33 KV Chilkalguda GIS (8KM)
- d) 132 KVSS Pattigadda to 132/33 KVSS Hussainsagar (9KM)
- e) 132 KVSS Erragadda to 132KVSS Balkampet U/G SC line (8KM)
- f) 132 KVSS Balkampet to 132KVSS Pattigadda U/G SC line(12KM)
- g) Hayatnagar 220 KVSS to 400/220 KV Ghanapur(33KM)
- h) 132KVSS Pattigadda to 132 KVSS Gunrock U/G DC XLPE UG cable(10KM)
- i) LILO of 220 KVSS Ghanapur to Imlibun to Moosarambagh GIS(36KM)
- j) Imlibun to PTO (Miralam Filter Bed)(5KM)
- k) Narayanaguda to Fever Hospital(5KM)
- l) Fever Hospital to Osmania University(8KM)

2.0 Scope of the work: The scope of work includes the following.

- 2.1.1 Design, manufacture, factory testing before despatch, packing, supply, installation, testing and commissioning of OLTE optical line terminal equipment signal transmission on 1310 nm / 1550 nm with required multiplexer equipment and digital signal protection equipment for voice, data including integration with the existing communication system in to. **The bidder shall do the detailed survey before quoting to ascertain the EHT line characteristics, hardware accessories, Railway crossings, Road crossings. Any incidental charges(Railway crossing, Road crossing, RoW, and crop compensation etc.) shall be borne by the bidder only.**
- 2.1.2 All the tools testing equipment etc required for installation, testing and commissioning of the system shall be provided by the successful bidder and the same shall be treated to have been provided in the bid prices. No additional claim shall be entertained by the purchaser at any stage of the contract.
- 2.1.3 Contractor shall supply equipment mentioned in the annexure, erection, testing and commissioning of the fibre optic communication system with proteciton equipment on the above line sections.
- 2.1.4 It is not intent to specify completely herein all the details of the design, and construction of equipment. However the equipment shall confirm in all respects to high standards of engineering, design and workman ship and shall be capable of performing in continuous commercial operation upto the bidder;s guarantee, in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have final authority to accept any work or equipment. Not

withstanding to any thing contained above, the offered equipment shall be complete with all components necessary for thier effective and trouble free operation. Such, components shall be deemed to be within the scope of bidder's supply irrespective of whether those are specifically brought out in this specification and / or the commercial order or not. Further the minimum principal parameters mentioned in the technical specification should be fulfilled.

It should be noted that all preliminary design information (such as distance between stations) are provided for bidding purposes only. The Contractor is responsible for the final design AND SYSTEM PERFORMANCE.

- 2.1.5 **Integration:** It is the total responsibility of the bidder to integrate the entire supplied equipment with the existing communiaction system (PLCC, OLTE, OFC, MUX, EPAX and RTU etc.) For transmission of speech, real time data the necessary information for integration will be furnished during engineering stage. However the bidder should supply any necessary cables, connectors etc required for integration without any additional cost.
- 2.2. **Guarantee :** The system shall be guaranteed for trouble free operation for twelve (12) months from the commissioning date. In case of failure within this period, the contractor shall replace the faulty equipment at no extra costs to the purchase.

2.3 System availability :

The fibre optic system consists of:

- a. Fibre optic terminal systems

The total system shall satisfy two types of availability: Calculated availabilty and Demonstrated availability.

The calculated avability will be the theoretical availability determined by a statistical calculation based on the mean – time – between – failure (MTBF) and the mean – time – to – repair (MTTR) of the components and subsystems comprising the fibre optic system.

The demonstrated availability will be an actual measured value determined during the system Availability test (SAT).

2.4 Calculated availability

The contractor shall submit detailed MTBF and MTTR data and the resulting availability analysis for the fibre optic terminal systems. The calculated failure rates of the units shall be listed and using these unit failure rates, the calculated availabilities of the equipment offered in the bid shall be calculated .the contractor's recommended maintenance and repair philosophy and spare parts inventories shall minimise MTBF and MTTR numbers in support of the calculated availability. The calculated system availability for fibre optic system shall be not less than 99.95% .

2.5 Operational stability

The fibre optic system shall be designed to operate within specified performance for at least 10,000 hours continuosly without the necessity for manual adjustment or servicing.

2.6 Operational life

The equipment shall be designed to have a useful operating life of at least 15 years with recommended servicing and replacement of parts. Such recommended services and replacement of parts shall be brought out in the bid.

2.7 Bidders qualifying requirement.

- 2.7.1 Bidders shall meet the specified qualifying requirements.
- 2.7.2 The equipment supplied should be suitable for working in a hostile environment with electrostatic discharges. EMI / EMC compensation shall therefore be provided in the, OLTEs and multiplexers in order to meet electro-magnetic compatibility (EMC) requirement.
- 2.7.3 The bidder should be capable of integrating the fibre optical system with the existing PLCC & fibre optic (SDH) networks existing in APTRANSCO.
- 2.7.4 ISO 9000 certified manufacturers would be preferred.

3.0 Test requirements:

Routine tests shall be carried out on the complete fiber-optic communication system and associated equipment to show that the guaranteed performance figures are achieved and that the equipment meets the requirement of this specification. The general particulars, and guarantees stated in guaranteed technical particulars and the relevant ITU-T or equivalent Indian standard shall be complied with.

3.1 Testing and inspection:

The contractor shall carry out the tests stated in accordance with the conditions of this specification. Any additional tests as in the opinion of the purchaser necessary to determine that the contract works comply with this specification shall be carried out either at manufacturer's work site or elsewhere in ordinary working conditions without any extra charge. Type tests may be omitted at the discretion of the purchaser if satisfactory evidence is given of such tests already made on identical equipment.

All materials used shall withstand satisfactorily such routine tests as are customary in the manufacture of the types of equipment included in the contract works.

Factory acceptance tests shall be carried out to the satisfaction of the purchaser and in his presence at such reasonable times as he may require. Not less than three weeks notice of all tests shall be given to the purchaser in order that he may be represented. As many tests as possible shall be arranged together. Six copies of the contractor's record of tests shall be supplied to the purchaser.

Measuring apparatus shall be approved by the purchaser and if required, shall be calibrated at the expense of the contractor at an approved laboratory. The contractor shall be responsible for the proper testing of the work completed or plant or materials

supplied by a subcontractor to the same extent as if the work, plant or material were completed or supplied by the contractor himself.

All apparatus, instruments and connections required for the above tests shall be provided by the contractor but the purchaser will permit the contractor to use for the tests at site any instruments and apparatus which may be provided permanently at site by the purchaser subject to the operation of the system and carrying out of other contracts and with condition upon the contractor accepting liability for any damage which may be sustained by the purchaser's equipment during the test.

The purchaser will also provide free of charge on site electrical energy, if available, for the purpose of approved preliminary tests and for the final tests. If further preliminary tests are necessary or if further final tests are required due to the contract works not complying with the conditions of this specification, the purchaser may call upon the contractor to pay the costs of providing the additional electrical energy required.

The contractor shall use his equipment for installation, jointing, testing and commissioning of OLTE equipment etc. And furnish suitable test procedures of all materials as required by the purchaser. The contractor shall invariably furnish a detailed document on the type tests, routine tests and factory acceptance tests including the test procedures at least 6 weeks prior to the programmed date of factory testing & inspection by purchaser's representative at the contractor's works and get the same approved by the purchaser who shall not take more than 2 weeks from the date of receipt of the test procedure document for its approval the date for factory testing of the cable, equipment by the purchaser's representative at contractor's works shall be communicated by the contractor immediately after approval. If required by the purchaser, test specimens shall be prepared for check testing and forwarded at the expense of the contractor to an independent testing authority selected by the purchaser. The cost of all such tests and/or analysis shall be borne by the contractor.

Waiving of inspection or performing of inspection by the purchaser of work, equipment or material, whether carried out or supplied by the contractor or subcontractor, shall not relieve the contractor from his liability to complete the contract works in accordance with the contract or exonerate/ relieve him from any of his guarantees.

4.0 Quality assurance procedures

4.1. General

The bidder shall operate a quality management system, which is in conformity with the requirement of ISO: 9001. The bidder will be responsible for the quality assurance of all goods and services through all phases of the contract from initial furnishing to final acceptance. This constitutes the assurance that all such goods and services are in conformity to the required quality in terms of technical specification, delivery, and commissioning and price requirement as defined in the contract.

4.2 Quality assurance system and requirements

The bidder's quality assurance system shall meet the following criteria:

- a) It will be formally accredited by an outside party as to compliance with the requirements of ISO 9001. Copies of all assessment and visit reports related to this accreditation shall be available to the purchaser throughout the duration of the contract.
- b) It shall be documented and presented in the form of the company quality manual, the associated quality system procedures at each bidder location involved in the project, and a quality plan specific to the contract.
- c) The first formal issue of the contract specific quality plan shall be agreed between the purchaser and the bidder prior to contract signing. This quality plan shall then form part of the contractual documentation and shall not be changed without prior agreement with the purchaser.

4.3 Additional quality assurance requirements

- a) The purchaser shall have access to the supplier's premises at any mutually agreed time and be provided access to inspect and assess the quality system should any specific need arises. The purchaser shall also be able to conduct on site reviews to discuss status, issues, progress etc., as deemed mutually appropriate. The bidder shall make available all the facilities during any visit to the works of manufacturer/ sub vendor.

The entire costs of the visits of the purchaser's representatives to the supplier's premises shall be borne by the purchaser.

- b) the purchaser shall have access to all relevant documentation including qualification and manufacturing test specifications and any other contract specific technical documentation including qualification test specifications for verification that the quality procedures are in accordance with the contract-specific quality plan.

When the supplier is satisfied that the goods and services are ready for release in accordance with documented procedures, the approval of the purchaser for release shall be sought.

When the purchaser is satisfied that the goods and services are ready for release, he will issue necessary written authorization. This authorization will not absolve the supplier from his responsibility for meeting the requirements of the contract, nor shall modify the commencement date of the warranty period.

5.0 Performance guarantee

The OLTE system shall be capable of continuous commercial operation for a minimum anticipated life span of fifteen years. The bidder shall also furnish the details of desired services and replacement of parts and its periodicity along with the bid. The system shall be guaranteed for trouble free operation for a minimum period of twelve (12) months from the final date of commissioning or eighteen (18) months from the date of supply whichever is earlier.

6.0 Documentation

All drawings shall conform to international standards organization (ISO) 'A' series of drawing sheet. All dimensions and data shall be in system international units. Wherever possible, the documentation should use standard symbols and vocabulary recommended by the international telecommunication union (ITU), and the international electro technical commission (IEC).

7.0 List of drawings and documents

The bidder shall furnish full description and illustration of the materials offered.

The bidder shall furnish the drawings, calculations, test reports and literature pertaining to specified items (6 copies) which shall include but not be limited to the following information:

- a) Name and location of the factory or company manufacturing the OLTE, multiplexers and all other equipment offered.
- b). technical standards, manufacturing technology and quality assurance system for the OLTE, multiplexers etc.
- c) Detailed description of the OLTE, multiplexers including block diagrams, section view, circuit diagrams and dimensions of overall equipment.
- d) Technical standards of all other main elements used in the equipment offered.
- e) Technical measures for ensuring the lifetime of 15 years with recommended servicing and replacement of parts.
- f) Schematic diagrams.
- g) Mounting drawings.
- h) Test reports and certificates showing compliance with all required tests.
- i) Specific instructions for installation of the OLTE, multiplexers etc.
- j) Description of quality control/assurance programme.
- k) Details of packing.

The supplier shall within 4 weeks of placement of order, submit three sets of final versions of all the above said drawings for purchaser's approval. The purchaser shall communicate his comments/approval on the drawings to the supplier within two/three weeks. The supplier shall, if necessary, modify the drawings and resubmit three copies of the modified drawings for purchaser's approval within two weeks from the date of purchaser's comments. After receipt of purchaser's approval, the supplier shall within three weeks, submit 10 prints, one set of good quality reproducible, one set of micro films of the approved drawings for purchaser's use.

Three (3) copies of acceptance and routine test certificates, duly approved by the purchaser, shall accompany the despatched consignment.

The manufacturing of the equipments shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the purchaser. All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at the supplier's risk.

6 sets of nicely printed and bound volumes of operation, maintenance and erection manuals in English language for each equipment shall be submitted by the supplier for distribution, prior to the despatch of the equipment.

The manual shall contain all the drawings and information required for erection, trouble shooting, operation and maintenance of the fibre optic cable and equipments. The manual shall also contain a set of all the approved drawings, type test reports etc.

8.0 Transportation

The supplier shall be responsible for transportation of all the equipment to each of the purchaser's site/stores including overseas and inland transportation, as well as for loading and unloading of the fibre optic cables and equipment.

The supplier shall make a careful examination of access rail-roadways to each of the site(s)/stores in order to confirm the practical maximum transport weight and dimensions, as well as a careful examination of the ports of disembarkation, in order to confirm the capacity of the hoist cranes installed there and the capacity of the access roads to those ports.

The supplier shall be responsible for the full cost of any repairs or restorations required due to transit, damage or otherwise altered due to the transportation of equipment in his supply, including the replacement of any posts, signs, pollards, etc., which have been damaged or moved and of any overhead wires or structures moved or brought down.

9.0 Insurance

The supplier shall insure all shipments and works at his own expenses for not less than the full replacement cost plus any additional cost for accelerated manufacture of the replacement parts. Loss of or damage to the equipment during shipping or transportation to the site/stores or other wise shall not constitute grounds for claims for extension in time or for extra payment.

10.0 Schedules required to be submitted:

The tenderer shall fill in the following annexures & schedules which form part of the tender specification and offer. If the schedules are not submitted duly filled in with the offer, the offer shall be liable for rejection.

Statement giving prices: for all recommended spares for ten years of satisfactory operation of each equipment.

Link design calculations : (power budget & rise-time budget)

Unless otherwise brought out separately by the bidder in the deviations, the offers shall be deemed to conform to the specification scrupulously. All deviations from the specification shall be brought out. The discrepancies between the specification and the catalogues or literature submitted as part of the offer shall not be considered as valid deviations unless specifically brought out in the schedule of deviations.

For any deviation from the specification, which is not specifically brought out in the schedule of deviation, the offer may be liable for rejection. The deviations brought out in the schedule shall be supported by authentic documents, standards and clarifications. Otherwise the offer may be liable for rejection.

11.0 Information to be filled invariably by the tenderer

For ready reference of the tenderer, the items of information required to be invariably furnished by the bidder in his offer are listed below:

- i) Four copies of the authentic English translation of each of the standards to which the offered equipment conforms in case those are other than the standards specified in this specification.
- ii) Drawing listed in clause no.7.0.

12.0 Training of purchaser staff.

The supplier shall be required to provide facilities for imparting training at no extra cost to 6 (Six) Engineers to be nominated by the purchaser (APTRANSCO) for OLTE and associated equipment at the manufacturer's works place for one week. An important objective of training is to increase the ability to control, supervise and carry out maintenance work on plant and equipment supplied and installed by the contractor. The supplier shall provide boarding, lodging and transportation to the training place as a part of the contract without any additional financial commitment to APTRANSCO.)

The training shall cover, at least the following:

- i) Detailed theoretical and practical training fiber optical terminal equipment, MUX equipments etc. .
- ii). Operation & maintenance and repairs technique required for efficient upkeep of \ fibre-optic communication system.
- iii). Test & measurement procedures.
- iv). The contractor shall ensure that the training course fully, encompass all aspects of The basic design, installation, commissioning and maintenance of the fibre optic communication system

13.0 Training instructors.

The training instructors provided by the contractor shall be fully qualified and experienced engineers, who have had experience and good knowledge of the English Language. They will have had experience of training engineers on similar topics and will be fully familiar with the plant or equipment to be supplied or installed.

13.1 Training programme.

The contractor shall develop and plan detailed training Programmes using training methods most appropriate to the subject matter and the level of trainees. These training Programmes shall be submitted to the purchaser for his approval at least 15 days in advance. The programme of training shall be discussed and finalized with the purchaser.

14.0 Reliability.

The requirements of communication channels for remote control are very high concerning reliability and security.

Reliability of the equipments offered shall be better than 99.99% per year availability for overall end equipment.

The bidder shall give the relevant data of reliability, MTBF & MTTR of the equipment & communication links.

15. BACK UP ASSURANCE:

The spares required towards maintenance of the equipments ordered shall be made available for replacement for a minimum period of ten years from the date of last despatch at a reasonable price.

16.0 DEMONSTRATION:

If required, a demonstration of equipment will be called for to assess the suitability of the equipment

17.0 Compatibility with other equipments.

The supplier shall be responsible for the integrated system working i.e. He shall ensure the compatibility and work ability of the system/sub-system offered by him with other equipments following part of existing or upcoming communication system viz. Power line carrier communication, digital microwave, electronic exchange, data terminal equipment etc.

It is the total responsibility of the contractor to commission the OLTE equipment Multiplexers.

18.0 Cabling:

All signalling cables within the telecommunication system, and the power supply cables are part of contractor's delivery and installation. Signal cables and power supply cables shall be placed apart from each other (minimum distance 150 mm). Redundant cables and cables to redundant equipment shall be placed in separate cable routes. All Contractor supplied inside plant cables and cable assemblies shall be constructed from non-PVC, fire/smoke resistant materials.

19.0 Compliance of standards:

The SDH equipment shall fulfill the latest version of ITU-T , ETSI & ISO standards and recommendations including the following minimum requirements:

Functional characteristics; G.957,G-783, G-764.

Transmission interface characteristics:

Optical fibre: G-652.

Optical interface G-707, G-957.

Output jitter (all optical interfaces): G-783, G-823,G-825.

Jitter tolerance(all optical interfaces) G-823,G-825.

Jitter transfer function(all optical interfaces) G-783.

Mapping & Demapping G-707.

SOH insertion and extraction G-707, G-783.

20.0 Equipment Shelf:

An equipment shelf be provided to hold all equipment modules and shall provide a backplane for system power and inter module communications. The shelf shall be capable of being mounted on a standard EIA 19 inch rack.

If more than one shelf is required at any site, multiple shelves shall be combined and shall function as one integrated node.

21.0 TESTING OF EQUIPMENTS:

21.1 SITE ACCEPTANCE TESTS

Following are the Site Acceptance Tests to be carried out in different stages of installation, erection, testing and commissioning:

- a. Pre-Commissioning Period - The Phase 1 Site Acceptance Test (SAT) including Pre-Commissioning tests.
- b. Commissioning Period - The Phase 2 SAT
- c. Guarantee Test - Guaranteed System Availability Test.

Site Acceptance Tests

21.1.1 The Site Acceptance Test (SAT)-I.

Site Acceptance Test for Telecommunication Equipment and Subsystems

Site acceptance test for telecom equipment and subsystems shall be conducted in two phases

(a) Phase 1 SAT (Installation & Pre-Commissioning tests) This phase includes SAT for all equipment & systems procured under the present tender.

(b) Phase 2 SAT (Integrated System Tests)

The second phase SAT covers the tests for overall integrated telecommunications system comprising all equipments.

The Phase 2 SAT shall commence after completion of the Phase I SAT. The contractor has the overall responsibility for planning and ensuring the success of the Phase 2 SAT.

21.2.1 Phase 1 SAT

I. Installation Testing

The Phase 1 SAT consists of installation testing of the termination equipment. The Contractor shall connect all inputs, and communications circuits (making all of the necessary adjustments) and verify the operation of these circuits. The field installation test shall be performed for all equipment at each location. If any equipment has been damaged or for any

reason does not comply with this Specification, the Contractor shall provide and install replacement parts at its own cost and expense.

The minimal installation testing requirements for the fibre optic and network management subsystems are provided in Tables below:

Table 1. Fibre Optic System Installation Testing

Item Description

1. Physical Inspection for conformance to drawings, rack elevations and appearance of equipment and cabling
2. Power supply/converter voltage measurements
3. Terminal transceiver performance testing
4. Service channel performance
5. User interface, alarm and control functional performance
6. Rack and local alarms
7. Network management interface and supervision performance
8. Input/Output interfaces
9. Safety and signalling earthing system
10. Simulation of failure conditions and failover of protected components

Table- 2 Network Management Subsystem Installation Testing

Item Description

1. Physical inspection for conformance to drawings, rack elevations and appearance of equipment and cabling
2. Power supply/converter/UPS voltage measurements
3. Workstation hardware inventory, configuration and characteristics
4. Demonstration of proper operation of all hardware, including workstations peripherals

II Pre-Commissioning Tests:

The pre-commissioning tests shall verify that communication between each test site can be performed. During this testing, actual link measurements should be made on each fibre optic link to verify compliance with designed system performance specifications. This phase of testing shall be conducted by the Contractor and witnessed by The Employer. Field adjustments should be made to meet established standards. However if the field adjustments fail to correct the defects the equipments may be returned to the Contractor with no obligation to the Employer. The exact content of the pre-commissioning tests shall be determined jointly by the Contractor and The Employer. Table-2 summarises the minimum requirements for pre-commissioning testing of the wideband communications network.

Table -3 Fibre Optic Network Field Communications Testing

Item: Requirement Description:

1. Verification of margins and link performance
2. Bit error rate measurements
3. Measurement of error seconds
4. Confirmation of channel assignments
5. Point-to-point checkout of each new VF/data channel installed
6. Verification of predicted link margins

The above tests shall be performed after final alignments, correction for test Equipment calibration and with measured transmit power adjusted (attenuated if necessary) to reflect guaranteed performance as noted in the Contractor's documentation.

21.2.2 Phase 2 SAT (Field Integrated System Test)

The tests for the Phase 2 SAT shall include the following tests for systems supplied.

- (a) Routine tests as can conveniently be applied on site together with any other which shall be agreed between the Contractor and the Employer.
- (b) System tests including in test configuration, all the equipment to satisfy the requirements of technical Specification.
- (c) Functional system tests to check the error-free and secure interfacing operationally between the existing systems and those delivered under this Package. Testing and, specifically, cutover shall be accomplished in a manner that will minimize the possibility of a communication system failure. The work will be scheduled with the Employer in order to accomplish an orderly completion of the work with minimum interruption to the Employer's normal operation. This may require performing some of the work after normal working hours or on weekends to minimize exposure to inadvertent outages.

The intent of the Phase 2 SAT (field integrated system test) is to demonstrate that the equipment is operational end to end under actual conditions, that all variances identified during factory and field installation and commissioning tests have been corrected, and that the communication equipment is compatible with other equipment at all locations. The Integrated System Test shall include all fibre optic and termination subsystems, and the network management subsystem.

22.0 Guaranteed System Availability Test (GSAT)

The telecommunications systems shall be subjected to a **Two hundred (200) hours** Guaranteed System Availability Test after installation at site and before being put into commercial service. The purpose of this test is to ensure in advance, the in service availability of the system and its component parts. Successful completion of this test with no more than an agreed number of unscheduled errors (to be agreed between the Contractor and the Purchaser) will constitute the hardware and software acceptance of the system.

22.1 GSAT Duration and Acceptance Deadline

The duration of the GSAT test shall be 200 hrs. If the Contractor is unable to demonstrate to APTRANSCO's satisfaction that the system has attained the acceptance conditions during an initial period of nine (9) days, then the acceptance period shall continue on a rolling basis up to an acceptance deadline of 18 days.

22.2 General Conditions for GSAT

The duration of the availability test shall be 200 hours.

During the availability test time, no adjustment shall be made to any equipment, unless specifically agreed with the Purchaser. During this period, in the event of failure of a unit/component the defective item shall be replaced by a spare unit/component without

interruption of the test, if possible and the damaged item shall be repaired and returned to its original position as quickly as possible.

By mutual agreement any period of running with faulty equipment may be regarded as not part of the test. If the break of the test occurs due to errors in excess of those defined, the test will be deemed as failed, and the Purchaser may require the test to be repeated from the beginning. Prior to the commencement of the tests, the behavior of the system to errors which are monitored by the software shall be demonstrated to the Purchaser as required. A schedule of alarm/failure printout and display messages will be required before such a demonstration. No additional program or data shall be read into the system except with the approval of the Purchaser. Following any such changes a printout may be requested to be made of the contents of specified memory locations. In the case of standby equipment, no automatic switchover to any alternative standby unit will be permitted, except when the switchover itself is being tested either manually or automatically. Internal checking routines which cause the equipment to correct an error automatically will be accepted, providing that no hardware switchover or disconnection occurs and that the test is otherwise correct in all details.

22.3 Test Program for GSAT

A test program or set of test programs shall be submitted for approval to the Purchaser before the commencement of the test. The program shall be sufficient to demonstrate compliance with the Test Procedure Specification and the program shall be designed to frequently check the operation of routines/parts which may normally be entered only rarely, as well as exercise all modules to prove the absence of interaction during interleaved operations. It should also be designed to simulate the system loading expected in order to expose any unforeseen software timing problems which may result in delays in updating or loss of data. The general test program shall include and interleave the following tests and provide the facilities as follows.

- a. Functional test of all functions.
- b. Functional test of all input, output, display and control equipment.
- c. Printout of both internal and external faults which may not be readily recognizable.
- d. Other tests necessary to meet the requirements of the Specification.

The general test program shall have a short cycle time which shall be according to agreement and shall be run continuously during the test period.

22.4 Acceptance Conditions

The Contractor shall agree with the Purchaser to a number of unscheduled errors per 20 hrs, above which the equipment will be deemed as having failed the tests.

The Bidder shall state in the technical proposal, the minimum number of errors expected to be achieved. The tests shall be deemed successful only if the following conditions are satisfied:

- a. The total allowable outage time is not exceeded.
- b. No errors in excess of the agreed figure and the system have run without corrections for a period of not less than 20 hrs in the availability test.
- c. Satisfactory results of functional tests.
- d. No series of errors/faults on a particular item, indicating a design weakness.

Should any equipment, or part of it, fail under test to give the required performance, further tests which are considered necessary by the Purchaser shall be carried out by the Contractor and the whole cost of the completed tests shall be borne by the Contractor. These requirements shall apply equally for tests on Subcontractor's equipment.

After satisfactory completion of the witnessed tests at the Contractor's factory, the equipment shall be submitted for approval during dismantling prior to shipping. No item of equipment shall be despatched to site until the APTRANSCO has given it's approval in writing.

TECHNICAL SPECIFICATION FOR OPTICAL LINE TERMINAL EQUIPMENT (OLTE) AND MUX

Section - I

Standards

The material shall conform to the following Indian / international standards, specified under and published unless otherwise specified in these specifications.

| Reference Abbreviation | Name & addresses |
|-------------------------------|--|
| Bs | British standards, British standards institution, 101, Pentonville road, n-190-ND, UK |
| IEC/CISPR | International electrotechnical commission, bureu central de la commission, electro technique international, 1 rue de verembe, geneva, switzerland. |
| Is | Indian standard institution, Manak bhavan, 9, bahadur shah zafar marg, New delhi – 110 001, india |
| Iso | International organization for standardization, Danish board of standardization Danish standardization street, aurehoegvej –12 Dk – 2900, heeleprup, denmark. |
| Nema | National electric manufacture association, 155 east 44th street. New york, ny 10017, usa. |
| Csa | Canadian standard association 178, raxdale boulevard, raxdale Ontario, canada m9w ir |
| Ieee | Ieee, 347 east 47th street New york, ny 10017a usa |
| Eia/ tia | Global engineering document 15, inverness way east Endlewood, colorado 80112 –5704 usa. |
| Nec | National fire protection association 1 battery march park Quincy, massachusetts 02269-0059 usa. |
| Jis | Japanese standards industrial 1024 akasaka 4- chome Minato – ku Tokyo, japan. |

Section- II

a) Technical specifications for SDH Type Optical Line Terminal Equipment (OLTE) with integrated Access Multiplexer equipment

1.0 Design, manufacture, factory testing before despatch, packing, supply, installation, testing and commissioning of SDH type optical line terminal equipment (OLTE) with a capacity of STM4 upgradable to STM16 with 1+1 path protection at optical level in each direction for signal transmission on 1310 nm & 1550 nm with Primary Multiplexer, Tele-protection equipment and combined NMS for voice, data and protection signaling etc. on the following 220/132 kv GIS EHT line sections.

- a) 220KV SS Malkaram to 220 KVSS Gunrock(23KM)
- b) 220 KVSS Chandrayangutta to 220 KVSS Imlibun (16KM)
- c) 220/ 132 KVSS Osmania University to 132/33 KV Chikalguda GIS (8KM)
- d) 132 KVSS Pattigadda to 132/33 KVSS Hussainsagar (9KM)
- e) 132 KVSS Erragadda to 132KVSS Balkampet U/G SC line(8KM)
- f) 132 KVSS Balkampet to 132KVSS Pattigadda U/G SC line(12KM)
- g) Hayatnagar 220 KVSS to 400/220 KV Ghanapur(33KM)
- h) 132KVSS Pattigadda to 132 KVSS Gunrock U/G DC XLPE UG cable(10KM)
- i) LILO of 220 KVSS Ghanapur to Imlibun to Moosarambagh GIS(36KM)
- j) Imlibun to PTO (Miralam Filter Bed)(5KM)
- k) Narayanaguda to Fever Hospital(5KM)
- l) Fever Hospital to Osmania University(8KM)

The digital multiplex equipment shall be designed to operate in electrical high-voltage networks and shall be suitable for installations in substations with harsh environment and high electromagnetic interference. it shall be highly reliable and provide secure communications for real time signals such as VOICE, SCADA, TELEPROTECTION, DATA including IP/ETHERNET and status/control signals. the equipment offered shall already be working successfully in telecommunication networks operated by power utilities. it shall comply with the latest ITU-T recommendations and ETSI standards and be able to be interconnected with legacy multiplex and other telecommunication equipment.

- 1.1 The successful bidder shall co-operate with the contractors for interfacing with any other optical fibre system for overall system integration.
- 1.2 **Training for Six purchaser Engineers at the manufacturer's site for one week.**
- 1.3 Arrangement for shipment, safe delivery on FOB port of shipment and CIF Indian port for equipment of non-Indian origin. Safe onward inland transport and delivery of equipment at the purchaser's designated store/destination for equipments of both Indian and non-Indian origin.
- 1.4.1 Putting the equipment to regular operation after testing and commissioning and guaranteeing its performance for a period of 12 months from the date of final testing and commissioning. It is not the intent of this specification to specify completely herein

all details of the design and construction of the equipment or materials to be supplied or services to be rendered. However, the equipment shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous operation as per latest international standards, in hostile electrical environments prevailing near extra high voltage grid substations, in absence of any air-conditioning environment. The purchaser will interpret the meanings of drawing, documents and specification and shall have the power to reject any work or material, which in his judgment is not in accordance therewith.

- 1.5 The equipment shall be in line with current practice as followed by Dept. of Telecommunication (Govt. of India) or by internationally accepted practices for communication system.
- 1.6 Whether called for specifically or not, all accessories (attenuators, patch cards, test probes etc) required for normal and satisfactory operation (as deemed fit by the purchaser) shall be considered to be a part of the tenderers basic scope of supply and no claim for extra payment will be accepted on these grounds.
- 2.0 The bidder shall furnish detailed instructions and precautions to be taken during handling at the port of entry, local transportation and handling at stores including long storage at purchaser's stores. This will in no way relieve the contractor from the overall responsibility of supplying the materials up to purchaser's designated destination store/ site.

3.0 Standards:

The goods supplied under this contract shall conform to the latest relevant ITU-T standard and/or other standards prescribed in the technical specifications.

3.1 EMC standards

Equipment offered under the scope of work shall, in general, be suitable for working in environment prevalent in and around extra high voltage switch yards. The equipment shall meet very high standards of electromagnetic compatibility. The following standards as amended up to date may serve as guidelines.

- i) EN 55022 radiated emission
- ii) EN 55022 conducted emission
- iii) IEC 801-3 radiated susceptibility
- iv) IEC 801-4 conducted susceptibility
- v) IEC 801-2 electrical discharge.
- vi) IEC 255-4 high frequency disturbance (damped voltage & current surges)
- vii) IEC 870 -2 voltage & current surges
- viii) IEC 801-5 - do -
- ix) CISPER pub.22 (class-a)

The bidder shall enclose proof of the offered equipments performance within the limits specified in the above standards and/ or any other international standards. A copy of the each of the other standard in English version shall be enclosed with the bid.

4.0 General technical requirements of OLTE & hardware

- 4.1.1 The equipment shall be modular in design, compact and composite construction including power supply, switching and control units.
- 4.1.2 The equipment shall be fully solid state, field proven and adopt state-of-art technology.
- 4.1.3 The mechanical design and construction of each unit sub-assembly shall be inherently robust and rigid under all conditions of operation, adjustment, replacement, storage and transport.
- 4.1.4 The equipment shall have self cooling arrangement. No forced cooling using fans etc. Is envisaged.
- 4.1.5 The equipment shall operate from a nominal 48VDC or 60VDC battery, positive grounded. The equipment shall work satisfactorily over battery voltage variations of +20% / -15% (40.8vdc - 72vdc). Redundant Power-supply (1+1 protection) shall be supported. The equipment shall support dual power feed i.e. that two power sources can be connected directly to the equipment (two connection points).
- 4.1.6 The plug in units, whose removal or insertion, when in operation might endanger the reliability or performance of the units, shall have suitable protection.
- 4.1.7 All important switches/controls on front panel shall be provided with suitable safeguards such as interlock system to avoid accidental operation by the maintenance personnel.
- 4.1.8 The equipment shall be made vermin proof, protected against dust and insects. The indoor equipment shall conform to IP52 and outdoor equipment to IS-2147.
- 4.1.9 The equipment shall be able to work in saline atmosphere in coastal areas and should be protected against corrosion.
- 4.1.10 All components shall be easily accessible for testing. Similarly all bays and bay-panel wiring shall be easily accessible.
- 4.1.11 Special tools required for wiring are included within the scope of the specifications and shall be provided along with the equipment.
- 4.1.12 Life time spares.

The purchaser would like to stock lifetime spares as and when the supplier decides to close down the production of offered equipment. In such an event, the supplier shall give at least one-year notice to the purchaser along with the list of recommended lifetime spares.

- 4.2.0 The supplier shall provide the following document.
- 4.2.1 Operational manuals: one copy with each equipment and 2 copies prior to inspection.

4.2.2 Installation manuals: one copy with each equipment and 2 copies prior to inspection.

The documents shall provide details for

- 1) Technical description
- 2) Configuration procedure
- 3) Power consumption

4.3 Operational requirement.

- 4.3.1 Each sub-assembly shall be clearly marked to show its function, schematic reference so that they are identifiable from the component layout diagram in the handbook.
- 4.3.2 Maintenance philosophy is to replace faulty units after quick analysis of monitoring and alarm indications and built-in test equipment. The actual repair will be undertaken at suitable centralized repair centre. The installation at site shall involve simply plug - in connection only.
- 4.3.3 Each station shall be provided with alarm interface card to take upto 8 external alarms (say air conditioned failure etc.)
- 4.3.4 The healthy, unhealthy and change of status condition of the units shall be displayed by leds and also should be seen from the network management system (nms).

5.1 Compatibility of equipment

Extension of the communication system shall be executed such that it will be best compatible with existing system(s) viz., OFC,PLCC, Microwave etc. and EPAXs with 4 wire E&M signalling. Care shall be taken that spare part holding and servicing will be similar for the whole system as far as practicable.

5.2 SDH Type Optical Line Terminal Equipment (OLTE):

Unidirectional OLTEs- 10 Nos

Unidirectional Managed Synchronous Digital Hierarchy (SDH) type, short haul (that can drive upto 60 Km) Optical Line Terminal Eqpt. Operating on 1310nm and 1550nm with a capacity of STM-4 up-gradable to STM-16, having 1+1 (loop & path) protection at optical level, redundant control unit, hot standby power supply with Primary MUX, Digital Tele-protection eqpt.(2nos.) with the following configuration:

E1 (Elec. I/F): 63 Nos.(Initially h/w provided for 32 E1s and wired for full capacity so that in future by adding E1s card full capacity can be utilised).

High speed Ethernet (10/100 base) ports: 8 Nos. with Layer 2 switching capability.

Digital Cross-Connect: 40 x E1s, Digital Distribution Frame, MDF, Engineering Order Wire Telephone.

Two directional OLTEs- 8 Nos

Two directional Managed Synchronous Digital Hierarchy (SDH) type, short haul (that can drive upto 60 Km) Optical Line Terminal Eqpt. Operating on 1310nm and 1550nm with a capacity of STM-4 up-gradable to STM-16, having 1+1 (loop & path) protection at optical level, redundant control unit, hot standby power supply with Primary MUX, Digital Tele-protection eqpt.(2nos.) with the following configuration:

E1 (Elec. I/F): 63 Nos.(Initially h/w provided for 32 E1s and wired for full capacity so that in future by adding E1s card full capacity can be utilised).

High speed Ethernet (10/100 base) ports: 8 Nos. with Layer 2 switching capability.

Digital Cross-Connect: 40 x E1s, Digital Distribution Frame, MDF, Engineering Order Wire Telephone.

5.2.1 GENERAL

The fiber optic equipment supplied under this project shall be based on the Synchronous Digital Hierarchy (SDH) technology. The SDH system shall be designed for digital transmission using single mode fiber optics and shall comply with ITU-T G.707. The telecommunication network shall mainly use fiber optic system including optical SDH equipment and associated accessories.

The SDH equipment shall be an ultra-compact, carrier class, and cost effective bandwidth provisioning equipment designed to manage and deliver services from the optical core to the access.

The SDH equipment shall be configured as a Terminal Multiplexer (TMUX), Add-Drop Multiplexer (ADM), and In-Line Amplifier or as stand-alone Cross-Connect.

SDH equipment shall be a STM-4/16 platform, has been envisaged to address the growing demand for an ultra-compact STM-4/16 Add-drop Multiplexer (ADM) and provide Ethernet-over-SDH/SONET mapping functions, including Link Capacity Adjustment Scheme (LCAS) with Virtual Concatenation (VCAT).

The SDH equipment shall support the following interfaces—STM-1o/e, STM-4o, STM-16o, E1/DS1, E3/D3 and 10/100BaseT/x and GE Interfaces.

SDH equipment shall be configured in various topologies such as linear, ring and bus.

The multiplexing structure of the proposed SDH equipment shall permit the extraction of individual circuits from high capacity systems having a the whole STM-4 frame. 1+1 Cross Connect facility shall be provided to enable interconnection between different channels and network components. The SDH equipment shall consists of redundant cross connect card with STM-4 optical interfaces and interface slots for equipping E1 and Ethernet interface modules.

The SDH optical multiplexer equipment shall perform both multiplexing and optical line terminal functions. All features and functions of the SDH multiplexer equipment shall be readily software configurable to suit operational requirements of the fiber optic communication system.

All optical SDH ports shall support SFPS (small-factor pluggable unit) for short, medium, long and extra-long optical communication. ALS (automatic laser shut-down) shall be fully supported.

5.2.2 SDH EQUIPMENT:

The rack mountable STM-4 system shall be capable of offering both data and TDM and Ethernet services on a single platform.

STM-4 up-gradable to STM-16 equipment shall be provided with STM-4 optical interfaces, n x 63 E1s, n x 8 port 10/100 Mbit/s, L2 Ethernet interfaces and Gigabit Ethernet interface.

SDH STM-4/16 equipment should be equipped with 1+1 protection for cross connect & timing module. System should provide STM-4/16 interfaces on each of the cross connect cards configurable as 1+1 MSP and SNCP.

The SDH transmission equipment shall be a next generation optical system capable of transporting both circuit based TDM traffic as well as packet based data traffic and shall be capable of being configurable in linear, 1+1 linear and ring configuration

The SDH equipment shelf should provide spare slots for equipping STM-16 (electrical / optical) interfaces in future.

SDH STM-4 equipment shall be up-gradable to STM-16 by changing the optical interface (SFP) without replacing the common control cards.

The SDH equipment should be multi-service provisioning platform with add/drop, terminal and cross-connect functionality for universal installation at all network levels and shall be capable of supporting regeneration in the same platform.

The SDH equipment shall support GFP –F encapsulation for Ethernet data. It shall support Status Message Scheme(SSM) for SDH timing. Network protection timing shall be as per ETSI/ITU

5.2.3 Cross Connection Capability of the SDH Equipment

SDH equipment switching matrix shall be provided in 1+1 redundant configuration and shall support for fully non-blocking cross connections:-

- a) Cross-connect capability with a granularity of VC-4, VC-3 and VC-12 bit rate
 - b) The cross-connects are non-blocking and can be created dynamically between STM rings terminating on the SDH network elements.
 - c) It should allow direct mapping of any 2 Mbps into any STM-4 aggregate.
- The equipment shall be equipped with redundant, decentralized cross-connection functions. The cross-connect capacity shall be at least 40x 2Mbit/s (i.e. 1200x 64kbit/s) and non-blocking. For high-density applications the cross-connect capacity shall be upgradeable up to 128x 2Mbit/s with a granularity of 64kbit/s. Cross-connection shall be possible at line to line, line to tributary, tributary to line, tributary to tributary.

5.2.4 Optical Aggregate Interfaces

The multi-service SDH transport system shall support multiple optical interfaces in the same platform. The interface should be compliant with ITU-T G.957 SDH specifications.

It should support for 1+1 MSP on STM 4/16 level and SNCP on VC-12/VC-3/VC-4 level.

Access Interfaces

The offered SDH STM-4/16 equipment shall support following service interface modules:-

- A) Cross-connect and timing and control system redundancy cards .
- b) STM-4 Optical Interface card
- c) 32x E1electrical interface card
- d) 8 port FE Layer 2 Ethernet interface card

5.2.5 E1 Interface Card (32xE1/DS1)

The E1 interface card shall provide line interfaces to 32 E1 channels respectively in both add and drop directions.

The E1 interface card shall have two Euro connectors at the front providing an interface for 32 and 31 E1/DS1 channels respectively. Status and Active LEDs are provided to indicate the power on and working status of the E1 interface card.

E1s shall be drawn from SDH eqpt. only and PDH eqpt. should not be used between SDH eqpt. and Primary MUX.

2.6 8xFE Switching Card (STM4 backhaul)

Ethernet interface module shall provide 8 LAN ports 10/100 Base-T (RJ-45) and two (2) SFP slots for GE interfaces.

Ethernet interface card shall be a tributary interface card, which provides line interface to 8x10/100 Mbps (FE) Ethernet ports. In addition to supporting EOS applications with an uplink bandwidth of STM-4, The Ethernet card shall capable of switching at L2 level and doing traffic classification from L2 to L7 level.

Status and Active LEDs shall indicate the power on and working status of the Ethernet interface card.

Ethernet L2 services EPL, EVPL, ELAN services with the following features shall be supported:

- a) It shall support auto-negotiation feature.
- b) At least eight 10/100 Mbps Tx/Fx Ethernet ports
- c) IEEE 802.3 Flow Control
- d) Support for dynamic provisioning using LCAS as per ITU-T G.7042.
- e) VLAN tagging and priority as per 802.1 p/q
- f) Advanced layer 2 protection
- g) Spanning tree protocol as per 802.1d
- h) Rapid spanning tree protocol as per 802.1 w

- i) Multiple spanning tree as per 802.1s
- j) VLAN, MAC learning and forwarding

5.2.8 SDH Capabilities

SDH equipment shall support 1+1 MSP function on STM-4 interface. SDH equipment shall provide bidirectional and unidirectional SNCP at VC-12/3/4 levels.

SDH equipment shall support GFP-F (ITU-T G.7041/Y.1303) encapsulation for Ethernet data.

SDH equipment shall support VC-12/3/4 - xv virtual concatenation (ITU-T G.707/Y.1322)

SDH equipment shall support LCAS (ITU-T G.7042) at VC12/3/4 -xv level, which shall provide dynamic bandwidth adjustment.

It should support the synchronous status message scheme (SSM) for SDH timing

SDH equipment shall support DCC transparency function. By using D1-D3 or D4-D12 channels, SDH equipment shall transparently pass through the management information of third party NEs.

The SDH equipment shall support EOW interface using E1, E2 channels.

To prevent personal injury from emerging laser light in the case of the fiber break, SDH equipment shall support Automatic Laser Shutdown (ALS) function according to ITU-T G.958 and ITU-T G.644.

5.2.9 1+1 Path protection

The equipment shall provide means to protect 64kbit/s channels. The protection shall be end to end from one interface (telephone, data, protection signaling) to the other. It shall switch automatically from the main channel to the standby channel. It shall be configurable whether the system switches back to the main channel (reversible switching) or not (non-reversible).

If a path has switched to its standby route because the main route is disturbed this shall be indicated with an alarm. the switching shall be done within the multiplexer without using the network management system.

5.2.9.1 1+1 section protection

The equipment shall provide means to protect STM-4 (MSP). It shall be possible to use two independent links: one as the main and the other as the standby. The system shall automatically switch to the standby connection and generate an alarm if the main connection is disturbed.

The switching shall be done within the multiplexer without using the network management system.

5.2.9.2 Synchronization and Timing

SDH equipment shall derive its clock from the following source:

Line-timed mode: In this mode, SDH equipment shall derive its clock from any one of the E1/DS1 tributaries or STM- 4/16 (OC-3/12) signals.

Externally timed mode: In this mode, an external 2048 KHz or 2.048 Mbps signal shall be used as the clock source.

Holdover mode: In this mode, SDH equipment shall use the stored timing data to control the output frequency for a short duration (of around 24 hrs). Beyond this it shall use its own internal oscillator in a free-running mode.

5.3 Protection

5.3.1 Equipment Protection Switching

Equipment protection switching shall accommodate various hardware failures while the transport facility is still functional. In an event of hardware failure, the hardware shall be substituted without affecting the traffic.

5.3.2 Cross-connect Card Redundancy

The SDH equipment shall facilitate the cross-connect redundancy by having main and standby cross-connect cards. Software on each cross-connect card decides which cross-connect card is the active controller. The active cross-connect card takes control of all the processor bus signals on the backplane. The processor bus is shared across all the tributary cards.

All the traffic related devices on each cross-connect card is always under the control of the active cross-connect card.

5.4 Power Supply Redundancy

The SDH equipment shall have two power supplies to facilitate power supply redundancy. The output of both the power supplies are shorted together on the backplane and then in turn given to all the cards.

SDH equipment shall be powered from DC power sources. The power supply card shall support -48 V (range -40.8 V to -72 V) DC power.

There shall be two power supply slots located on the chassis for equipping the power supply modules.

5.5 Protection and Redundancy

SDH equipment shall support multiple layer network protection functions and multiple layer protection escalation. The network protection functions supported shall be as follows:

- a) MSP 1+1 protection at STM-4/16, Unidirectional or bi-directional, revertive or non-revertive modes, in compliance with ITU-T G.783/841
- b) SNCP at VC-12, VC-3 and VC-4 levels, single ended, non-revertive and revertive in compliance with ITU-T G.783/841.

- c) The switching time for above protections in case of failure shall be less than 50 milliseconds
- d) LCAS protection
- e) Rapid Spanning Tree Protocol (on cards incorporating layer 2 switching capabilities), in compliance with IEEE 802.1w, Spanning tree protocol shall prevent against loops at the Ethernet level of the network while providing L2 protection.

The optical line terminal equipment (OLTE) shall convert ‘at the send end’ STM-4 digital signals based on the 2048 kbps hierarchy, into optical signal for transmission over an optical fibre media and perform the reciprocal function on the receive side. Separate fibres shall be used for transmit and receive. Transmit/receive on single fibre is not acceptable.

5.6 OLTE shall comprise following modular units.

Transmit unit

- Code converter (transmit),
- Optical transmitter,

Receive unit

- Optical receiver,
- Code converter (receive),

Miscellaneous units

- Alarm control unit,
- Protection switching,
- Order wire unit/ service data interface unit
- Power supply unit.
-

5.6.1 Optical transmitter and receiver

The type of opto-electronic devices proposed shall be stated by the tenderer and shall be to the approval of the APTRANSCO. Data concerning the reliability of the opto-electronic devices, accelerated tests of device life time and mean time between failure (MTBF) calculations etc shall be submitted for approval.

Full automatic gain control (AGC) shall be provided for the optical receiver to cover a wide range of input levels, due to various cable lengths, and to provide temperature compensation of the detecting device.

The output power of the transmitter optical device and optical power at the receiver shall be designed such as to provide the same mean BER in each section as specified in this tender.

Bidder shall submit power budget calculation along with the offer.

5.6.2 Code converter (transmitter)

The code converter (transmitter) shall regenerate and equalise the ITU-T standard coded signal received from the digital multiplexer equipment and convert this to binary bit

stream. Overhead bits for the service data channel shall be inserted into the aggregate data stream before conversion to the chosen optical signal code.

5.6.3Code converter (receiver)

The code converter (receiver) shall convert the received optical signal to binary form and extract the overhead bits for the service data channel before further conversion to the ITU-T standard code used at the remote transmitter. The standard coded signal shall then be passed to the digital multiplexer equipment.

5.6.4Alarm control unit

The operating conditions at each terminal and at each repeater shall be monitored by an alarm control unit associated with that equipment. This information shall be transmitted to each terminal equipment for processing via the service data channel. It shall ascertain alarm conditions to be detected and a command shall be given to the protection switching to changeover to the stand-by system. The following system faults shall cause line switching to occur:

- Loss of optical input signal,
- Loss of optical output signal,
- Loss of synchronisation,
- Excessive bit error rate.

5.6.5 Protection switching

The OLTE shall be equipped with two optical transmitter/receiver pairs (one used as normal system, the other as stand-by system) connected to two different fibres on the transmission side, and to another two on the reception side.

On receipt of a command from the alarm control unit, the protection switching shall automatically transfer all traffic from the normal to the stand-by system. Traffic shall resume on the normal transmission system when the fault detected by the alarm control unit has been cleared. Provision shall however be made to permit traffic to stay on the stand-by system until a fault occurs on the stand-by system, even if the normal system is restored to a healthy condition.

Provision shall also be made for traffic to be forced switched by bypassing the control circuit with a manually operated switch. Switch over shall also be possible by a remote command issued from a centralised fault supervision system.

Equipment entering the redundant state shall initiate alarm indications and shall also initiate the changeover signal. The switching criteria in the automatic mode shall be based on the following fault conditions being detected within the system:

- An alarm initiation signal (AIS),
- Loss of incoming signal (LIS),
- Bit error rate (BER) $> 5 \times 10^{-4}$.

Both AIS and LIS shall be considered as major fault conditions. The status of all signal path switches shall be indicated on the equipment. Switching shall be completed within 50 ms from time of detection of fault condition that initiates the protection switch to time of changeover of signal path.

5.7 Engineer order wire telephone

In order to facilitate maintenance of the fibre optic communication system, an order wire telephone channel shall be provided. Selective calling, using dual tone multi-frequency (DTMF) signalling, shall be provided.

The engineer order wire telephone signal shall be PCM to produce digital signals at 64 kbits/s. These signals shall be presented to the service data interface for inclusion in a composite signal to be processed by the code converters for transmission in the service data channel.

This 64 kbps channel shall be over and above 8MBPS transmission capacity of the equipment.

5.8 Clock signal:

The system shall have its own internal clock for synchronisation purpose. Also it shall have the capability to regenerate clock signal from the 2 Mb stream received from nearby station. The system shall also accept external clock signal to be given from any reference station.

The priority of working of the clock signals is as below:

1. External clock from reference station.
2. Clock regenerated from 2 Mb stream
3. Internal clock

5.9 DIGITAL DISTRIBUTION FRAME.

Digital distribution Frame with a capacity of 63 E1s shall be provided. Initially, DDF is terminated with 32 E1s (E1 Tributary capacity) with all necessary cables and connectors both for transmitter and receiver. Interfacing cables for 32 E1s shall be provided with connectors for SDH equipment side to interface with the Multiplexes or existing fibre optic equipment in APTRANS CO.

All suitable Connectors for both ends along with 100 metres cable and 2 Nos.

Crimping tool shall be supplied as mandatory spare to terminate spare E1s in future.

5.10 SNMP COMPATIBILITY:

The offered equipment under the present project(OLTE, MUX and Digital Tele-protection eqpt.) shall be compatible to SNMP (Simple Network Management Protocol). It shall be able to integrate to the third party Network Management system. The supplier shall handover the MIB (Management Information Base) file of the offered equipment to APTRANS CO and shall extend his cooperation for integration of the equipment to the 3rd party Network Management system during the execution of the project or after. The supplier shall show demonstration on how he is going to integrate his equipment to the one of the existing NMS available with

APTRANSCO. The bidder can view the existing NMS at APTRANSCO with a prior intimation and approval before bidding.

b) Technical specifications for multiplexer (MUX) equipment

The telecommunication system to be offered shall comprise of optical fibre system which is intended to be used for:

- Voice communication.
- Tele-protection signalling.
- Data transmission.
- Facsimile communication.
- Video conferences

5.3 Multiplex equipment (MUX) PCM:

The equipment shall be designed and tested in accordance with ITU-T G.742 and G.823 recommendations.

The 2 MBPS multiplexer shall be standard PCM multiplexer, providing 30 digital and/or analogue channels with associated signalling, in accordance with ITU-T G.711, G.712, and G.732 recommendations. The equipment shall be provided with redundant power supply module. At each station the PCM MUX shall be provided suitable for 120 channels so that in future the channel capacity can be increased by just inserting the interface modules.

PCM multiplexer should take one clock input of 2 MHz for synchronization and shall able to give at least one-clock outputs for synchronization of other equipment in a station.

The equipment shall serve as the basic system for the higher digital hierarchy levels in accordance with ITU-T G.702 recommendation. Digital interfaces at 64 kbits/s and 2,048 kbits/s shall be provided in accordance with ITU-T G.703 recommendation.

PCM transmission shall be based on a sampling rate of 8,000 samples/s of each incoming VF element. The encoding law used shall be a-law using 8 binary digits per sample, thus generating a 64 kbits/s signal in accordance with ITU-T g.711 recommendation.

32 channels of 64 kbits/s each, transmitted in 32 time slots of 8 bits per frame, shall build up to a digital bit stream of 2,048 kbits/s. 30 channels, corresponding to 30 time slots, shall be for speech/ data channels. Time slot # 0 shall be used for frame alignment and remote supervision whilst the remaining timeslot (timeslot #16) shall be used for channel associated telephone signalling.

Signalling units shall be provided at both subscriber and exchange ends of the system for PCM line working. The type of signalling unit shall be as stated in the technical specifications.

The rated supply voltage shall be 48 to 60V DC, however the equipment shall be able to work in the range of 48 V (-15%. To +20%)

The multiplex and signalling equipment shall be equipped with circuits to detect at least the following:

- Loss of incoming signal (2,048 kbit/s),
- Loss of frame alignment,
- Bit error rate (BER) greater than 10^{-3} ,
- Alarm indication signal (AIS) detection,
- Failure of 64 kbits/s interface (signalling only),
- Failure of power supply.

The speech companding law employed in encoding and decoding shall follow the logarithmic A-law with the value of A=87.6 and approximated by 13 segments. Single channel code structure is preferred. The MTBF shall be $\leq 10^5$ hours at operating temperature conditions. The tenderer shall indicate the MTBF at standard temperature conditions.

The PCM multiplexers shall be installed in same distribution rack as that for OLTE.

Digital interfaces at 2,048 kbits/s shall be provided in accordance with ITU-T G.703 recommendation.

Signal bit rates shall be 2,048 kbits/s +/- 50ppm and signal code format shall be HDB3. The impedance shall be 75 ohm unbalanced.

Loss of frame alignment shall be considered to have occurred when 4 consecutive frame alignment signals are incorrectly received in their predicted positions. When 3 successive frame alignment signals are correctly detected, the system may be deemed to have regained frame alignment.

In a given frame, the status of the cyclic bit contained in the justifiable digit time slot associated with a particular tributary shall be indicated by means of 3 relevant justification control bits, in accordance with table 1 of ITU-T G.742 recommendation. Positive justification shall be indicated by the signal 111; and no justification by the signal 000.

The maximum permissible limits of jitters at the 2,048 kbits/s interfaces shall be in accordance with table 1 of ITU-T G.823 recommendation.

With the following input signals encoded in hdb3 format, at a bit rate of 2,048 kbits/s +/- 50ppm, connected to any 2,048 kbits/s input port, the error rate introduced at the corresponding 2,048k bits/s output port, shall be less $5 \cdot 10^{-11}$:

- a rated aggregate signal
- a repetitive signal having a block length of 8 bits,
- an all binary zeros signal,
- an all binary ones signal.

This requirement shall be met for all signal conditions on the remaining 2,048 kbits/s input ports. The output tributary bit rates of all tributary outputs shall remain within 2,048 kbits/s +/- 50 ppm when any 2,048 kbits/s input tributary signal is lost.

With the following conditions at one or more input ports, the remaining tributaries shall continue to function within their specified limits:

- no input signal,
- input signal outside the limits of this specification,
- removal or insertion of any of the tributary cards other than those cards appropriate to the tributary under test.

The following fault conditions shall be detected and alarm indications provided, in accordance with clause 10 of ITU-T G.742 recommendation:

- failure of power supply,
- loss of incoming, 2,048 kbits/s tributary system at input port,
- loss of frame alignment, alarm indication signal (AIS) from remote multiplex equipment.
- bit error rate (BER) greater than 10^{-3} ,
- failure of multiplex-demultiplex timing,
- failure of 2,048 kbits/s AIS clock,

All the E1s shall be derived from the SDH frame only and no PDH shall be used. E1 Tributary card shall be an integral part of the SDH eqpt

All equipment shall be of modular construction and installed in the same distribution rack as of the OLTE. They shall be wired for their maximum capacity at 64 kbps & 2 Mbps level; future extension shall be possible by simple field installation of the appropriate modules.

For testing purpose remote/local loop back at 64 kbps as well as at 2 Mbps shall be possible by using software. Bidder shall explain how the testing will be carried out by using these loops.

The rated supply voltage shall be 48 to 60 V DC, however the equipment shall be able to work in the range of (-48 -15% to +20%) V DC. Redundant power supply shall be provided.

The equipment shall be compatible to the existing one in order to cater for any upgrading without limitation. at present 2 mbps system is envisaged. Synchronisation at 2 Mbps level with external signalling received from the existing OLTEs shall be possible.

Equipment at each end station shall be capable of providing 60 channels so that number of drop/insert channels can be increased in future by just inserting the interfacing modules.

Bidder shall provide the full capacity termination for unused 2 Mbps signals at each station which shall provide transparent 2 MBPS interfaces for transmission of 2 Mbps signal from these stations to other directions.

Configuration of MUX equipment shall include the following interface cards at each station:

1. Voice frequency modules suitable for 2 hot lines.

- 2. Voice frequency 4W E&M modules suitable for min 16 ports**
- 3 .G.703 data interface modules suitable for min 4 ports**
- 4. V.35 data interface modules suitable for min 4 ports of n x 64 kbps**
- 5. V.24 / V.28 data interface module suitable for min 4 ports.**
- 6. V.11 data interface module suitable for min 4 ports**
- 7.External Alarm interfacing for 8nos.**

5.3.1 MAIN DISTRIBUTION FRAME

Main Distribution Frame with a capacity of 100 krone for termination of voice and data circuits shall be provided. Subscriber lines and Trunk lines are to be terminated on the MDF on one side of the terminal-block with the legend of the terminal connections clearly indicated in alphanumeric. The MDF shall be provided with individual surge protection.

Krone tag blocks are preferred to be used for the MDF. The supply of relevant wire terminating tool (Krone tool) shall be supplied.

All the subscriber lines and the trunk lines shall be provided with surge protection. Invariably suitable surge protectors in the form of Gas discharge tubes and fuses are to be provided to protect electronic circuitry of the MUX equipment from the damages due to external surges /spikes. Minimum maintenance and free workability on the equipment is to be ensured.

5.4 Network Management System

The Network Management System shall be common for primary OLTE , multiplexer and Digital Tele-protection equipment. The hardware platform shall be PC based. The man machine interface shall use mouse and window technique. The software of MIB file of OLTEs, MUX and Digital Tele-protection equipment should be provided to interface with existing NMS of APTRANSCO.

The network manager shall be able to address any of the primary multiplexer and second order multiplexer. The network manager shall have four levels of interaction with password protection limiting the access to the users. From the software it shall be possible to program the multiplexers, do the level settings etc without any necessity of hardware settings. It shall be possible to do the monitoring and configuration of remote network element from NMS station. The necessary embedded operation channel for the NMS shall be provided by the bidder. This embedded operation channel shall be in addition to the engineer order wire mentioned elsewhere in the specification. It shall be possible to remotely configure the system from the master station upto 64 kbps level thus obviating the need for any handheld terminals at other stations.

The NMS program shall be based on windows with its well known mouse operated “pull down menu and interactive communication box technology. By using embedded data channel it shall be possible to configure all network elements remotely from NMS.

The main objectives of the NMS software are:

- Checking the user authorization and allow/deny access to the user
- Display of the SW version
- To be used as a tool to write and store the configuration files
- Control the interactions between pc and communication equipment
- Identification of particular communication equipment
- Loading the configuration data to the database of the communication equipment
- Copying the database of the equipment and convert/store it as a configuration file
- Allow temporary changes of the configuration for test purposes
- Setting individual parameters
- Printing reports

5.4.1 General:

Network Management System (NMS) shall be provided as a part of this procurement. This NMS shall provide the capability to monitor, reconfigure, and control elements of the equipments supplied under this procurement. The above capability shall be provided at centralized location, 220 KVSS Malkaram. The NMS shall be capable of managing minimum of Fifty Nos.(50 Nos.) Network Elements and shall be upgradable to manage 100 Nos. Network elements minimum in future.

- NMS shall provide display of faults for complete equipments under this contract at central location, 220 KVSS Malkaram . Following types of faults management shall be provided by NMS:

- 1) Real Time alarm monitoring
- 2) Alarm acknowledgement
- 3) History of alarms storage & retrieval
- The NMS supplied by Contractor shall be capable of upgrading to support an Integrated TNMS.

• Technical Characteristics – General:

- The management system should follow the ITU-T Recommendations. Management Framework (IS 7498-4), which defines the following management facilities needed by the Employer as follows:
 - a) Configuration management.
 - b) Fault management
 - c) Performance management
 - d) Security management

• CONFIGURATION MANAGEMENT

• General Requirements:

- Configuration management is concerned with management, display, and control of the network configuration. Specific requirements that shall be satisfied include the following:
- a. Provide tools to establish and maintain the backbone topology and configuration information and provide graphical maps depicting the configurations.
- b. Gather descriptive information about the current configuration of the equipment, provide operator displays, and prepare report.
- c. Provide tools for planning, establishing, and changing the static equipment configuration. Provide for changes to the equipment configuration in response to

equipment failures, planned upgrades, and operator requests to take equipment offline for testing.

- d. Provide verification testing to support new equipment installation.
- e. Provide a database capability to maintain various types of information, such as:
- 1. Network equipment assets, including manufacturer, model number, maintenance record, and maintenance telephone contact.
- 2. Future data to be defined by Employer after commissioning.

- **Fault Management:**

- **General Requirements:**

- Fault management is concerned with detecting, diagnosing, bypassing, directing service restoral, and reporting on all the equipments supplied under this tender. Specific requirements that shall be satisfied include the following:
 - a. Display equipment status in a consistent fashion regardless of the source of the data on a graphical topological, map-type display. Status shall be displayed through the use of colours on links and nodes as well as through text.
 - b. Obtain status and detect faults through periodic polling, processing of unsolicited alarms and error events, and periodic testing for connectivity.
 - c. Maintain an alarm summary of unacknowledged alarm events on the management station display and maintain a log of all received alarms. The operator shall be able to acknowledge and clear alarms individually and as a group. The use of alarm correlation techniques is encouraged to minimize the proliferation of alarms caused by a single, common event.
 - d. Provide the capability to diagnose and isolate failures through analysis of error and event reports and through the use of both on-line and off-line diagnostic tests and display of monitored data.
 - e. Bypass failures through the use of automatic failover to redundant equipment where possible and through operator-initiated actions where automatic failover is not possible. The criteria for failover shall be configurable. As an example, the NMS shall support the transfer of switching orders to hot-standby fibre terminal equipment configurations and drop insert equipment .
 - f. Track network equipment failure history.

- **Power Failure:**

- After a power failure, all equipment shall return without any manual reset to the same mode as before the failure.

- **Performance Management:**

- **General Requirements:**

- Performance management is concerned with evaluation of the use of network equipments and their capability to meet performance objective. Specific requirements that shall be satisfied include the following:
 - a. Monitor point-to-point and end-to-end signal quality & history.
 - b. Provide operator controls to monitor performance of specified events, measures, and resources. Specifically provide displays to permit the operator to:
 - 1. Select/deselect network equipments, events, and threshold parameters to monitor.
 - 2. Set monitoring start time and duration or end time.
 - 3. Set monitoring sampling frequency.

- 4. Set/change threshold values on selected performance parameters.
- 5. Generate alarm events when thresholds are exceeded.
- 6. Set multiple thresholds on certain performance parameters. Alarm categories include as a minimum a warning and a failure.
- 7. Provide graphical displays of current point-to-point and end-to-end performance parameter values. Provide tabular displays of current, peak, and average values for performance parameters.
- 8. Generate reports on a daily, weekly, monthly, and yearly basis containing system statistics.
- **Security Management:**
- **General requirements:**
 - The NMS shall be provided with security features to limit access to monitoring and control capabilities to only authorized personnel. Authentication techniques shall be provided to verify the identify of anyone trying to access the NMS or any operator interface where network parameters may be viewed or changed. Command security shall be ensured, if possible through use of redundant data communication channels providing command results annunciation and alarms if
 - command is not executed. Access methods shall be provided to limit access to only authorized users of the NMS. At least three levels of access shall be provided – none, read only, and write.
 - With “read only” access level, network parameters should only be viewed. Access to database maintenance, command control and test functions shall be available with “write” access level. Means shall be provided to ensure only one authorized user has “write” capability for a selected domain of the network. It shall be possible to define multiple domains for purposes of monitoring and control.
- Human error and conflict detection are also required. Such errors and access violations shall be reported to the offending user as error messages & warnings. Repetitive violation of security measures shall generate an intrusion alarm, which shall be logged and displayed at all authorized operator management stations. Physical intrusion detected should be reported as an alarm condition.
- **Operator Authorization Levels:**
 - Two levels of operator authorization, as a minimum, shall be provided.
 - a. Monitoring Level: Monitoring Level operators are authorized to supervise the network, but should not be able to change the configuration of the network.
 - b. Master Level: Master Level operators can supervise the network and carry out protected functions such as change network configuration & other functions such as database maintenance functions. Authorization at the master level may encompass the whole network or only a part of it.
 - Monitoring Level A monitoring level operator shall have access to at least the following items or
 - features:
 - a. Diagram of the network.
 - b. Name of network elements (NE).
 - c. Connections between NEs.
 - d. Faults in NEs.
 - e. Faults in lines.

After the selection of a link or a network element, the operator shall have access to the following information:

- a. All signals with status between two NEs.
- b. All input signals with status to NEs.
- c. All output signals with status from NEs.
- d. Faults in plug-in unit level.
- e. Equipped units in subrack.
- f. Unequipped units in subrack.
- g. Priority levels (class)
- Master Level:
 - The master level operator shall be able to make the following configuration changes:
 - a. Increase the number of NEs.
 - b. Create new or revised connections between two network elements.
 - c. Decrease the number of NEs.
 - d. Remove the connections between two network elements.

• **Alarm Indications:**

- The following types of alarms shall be provided as a minimum in addition to other alarms generated as described above.
 - a. Transit frame alarms (e.g. input data failed)
 - b. Receiver frame alarms (e.g., BER>10⁻³ or > 10⁻⁶)
 - c. Receiver alarms (e.g., AGC at max)
 - d. Switch over requested.
 - e. Power supply alarms.
 - f. Quality parameter indications according to ITU-T recommendation G.821 (erroneous seconds, highly erroneous seconds, degraded minutes).

• **Equipment Requirements:**

- In general the minimum monitoring and control requirements for the communications equipment are summarized in above Tables.

• **Table-2-3-Fibre Optic Transmission Equipment Alarms and Indicators**

- 1 Device Status
- 2 LED/Laser drive current
- 3 Transmit Output Power Failure
- 4 Transmit Frame Alarms
- 5 Receiver Frame Alarms
- 6 Receiver Alarms
- 7 Quality Parameter Indicators
- 8 Loopback Actuated Indicator
- 9 Configuration Status
- 10 Power Supply/Converter Alarms
-

• **Table -2-4- Higher Order Multiplex Equipment Alarms and Indicators**

-
- 1 Device Status
- 2 Clock Supply Failure
- 3 Loss of Frame Alignment
- 4 Frame Parity Check Failure
- 5 Quality Parameter Indicators

- 6 Configuration Status
- 7 Tributary Alarms
- 8 Loopback Actuated Indicator
- 9 Power Supply Alarms

- **Table 2-5- Station Alarms, Indicators and Controls**

- **1 Intrusion Detection alarms**

- 2 Power Failure
- 3 Fire and Smoke Detection
- 4 Environmental Control (temperature, humidity, etc.)

- **NMS Configuration:**

- Each node on the backbone network shall include provision for connecting a laptop PC to support local commissioning and maintenance activities. Through the use of this PC and local displays/controls, the local operator shall be able to:
 - a) Change the configuration of the station.
 - b) Perform tests.
 - c) Get detailed fault information.
- The Laptop P.C. shall be connected to Ethernet/Management interface available at terminal and repeater stations. **Four** identical portable (Laptop) computers, each complete with necessary system and application software to support the functions listed above, shall be provided.

- **Interfaces:**

- The NMS shall be equipped with graphic workstations in the stations which are defined in the scope of supply.
- A Q1 – interface (ITU-T Rec. G.771) is required for network elements as defined in ITU-T Recommendations.
- The Bidder shall include the detailed information of the interfaces, especially concerning the lower layer protocols and bit rates supported.

- **NMS Architecture:**

- The NMS architecture shall be described in detail in the proposal. The following subsystems or features shall be described:
 - a. Database used in NMS.
 - b. Desktop PC, hardware, software and operating system.
 - c. Graphic display terminals.
 - d. Laptop PCs.
 - e. Data communication between nodes and NMS computer.
 - f. Maximum number of Network elements that could be handled and number of systems.
 - g. License details.

- **Configuration of NMS PC:**

The network management for the ordered system shall cover the following SW and HW.

- a) P-IV, dual core with 2.8 GHz and HT technology.
- b) 4 GB RAM
- c) DVD R/W
- d) Multimedia keyboard
- e) Optical mouse
- f) 500 GB HDD
- g) 19'' TFT color monitor
- h) 10/100MBPS Ethernet card
- i) 4nos. of USB ports in front side

- j) one serial port
- k) Computer table
- l) Computer chair
- m) Laser printer
- n) All necessary SW (MS, OS, drivers, anti -virus etc.) shall be supplied in the form of CDs also.

6.1 Installation of OFAC:

Installation in cable trenches and on cable trays.

Each OFAC shall be pulled in HDPE pipe of 40 mm diameter and required thickness (mm) placed in cable trench (separate trays for OFAC's). There shall be spare HDPE pipes for the OFAC's to be decided by the Purchaser. The pulling instructions and minimum bending radius shall be indicated by the bidder. The route for laying the OFAC shall be decided by the contractor in consultation with the Purchaser. The supply of the HDPE pipe and OFAC is covered in different package. Contractor shall terminate the fibres in Fibre Distribution Panel and OFAC shall be spliced with OPGW/ADSS at the gantry.

6.2 Burial.

In the case of direct burial the OFAC shall be installed in HDPE pipe of 75 mm diameter and required thickness (mm) to a depth of 1.0 m . The pipe shall be embedded in M 15 concrete with cover of 37.5 mm (150 mm overall) and the trench filled with excavated material and hand compacted. The route for laying the OFAC shall be decided by the contractor in consultation with the Purchaser. The supply and burial of the pipe is the responsibility of the contractor.

6.3 PIGTAIL CORDS.

The pigtail cords will be used for the interconnections of the approach cables with the respective optical terminal equipment. The optical fibres of the pigtail cords and approach cable shall be fusion spliced and protected in an approved type terminal box.

On the optical equipment side, FC-PC type optical connectors shall be used. Insertion loss shall not exceed 0.5 dB and return loss shall not be less than 35 dB. **The pigtail cords with optical connectors, terminal boxes and flexible corrugated tubes are an integral part of the scope of supply of the UG OFC/OFAC manufacturer.** The technical specifications of the pigtail cord with a connector, terminal box and of the tubing offered shall be provided with the bid.

TECHNICAL SPECIFICATION

DIGITAL TELEPROTECTION EQUIPMENT

1.0 Protection signalling equipment (compatible to fibre optic equipment)

The protection signalling equipment is intended for providing (i) intertripping (ii) direct tripping (iii) blocking commands of HV lines.

Digital protection signalling equipment shall be provided which shall be suitable for communicating through fibre optic equipment.

Digital Tele-protection coupler equipment shall be an integral part of offered OLTE & MUX equipment for the links as specified in item no.1 of schedule of requirement. Digital Tele-protection equipment shall be provided with visual trip counters event registers to register events which can be down loaded in to pc or laptop.

The protection signaling equipment shall have digital electrical output preferably V.11 interface or G.703 interface. Bidder shall quote for protection signaling equipment suitable for 8 commands with trip counters event registers in each equipment and suitable for transmission on V.11 electrical interface .

High security and dependability shall be ensured by the contractor. probability of false tripping and failure to trip shall be minimum. curves / figures indicating above-mentioned measures shall be submitted with the tender proposal.

If not otherwise stated routine and type tests of the protection signalling equipment shall consider the IEC recommendations and suggestions of the latest revision.

1.1 Principle of operation during normal operation protection signaling equipment shall transmit a secured guard code. in case protection signaling equipment receives one or more command it should interrupts the guard code and shall transmit the command code in sequence. the receiver recognizes the command code and absence of the guard code and generates the command.

All signal processing i.e. the generation of tripping signal and the evaluation of the signals being received shall be performed completely digitally by using dsp. the digital techniques thus employed obviate any need for calibration.

1.2 Loop testing an automatic loop testing routine shall cyclically checks the Tele-protection channel. the test signal shall be transmitted in the same way as the genuine tripping signal shall be recognized by the receiver and shall be reflected back to the transmitter. in case test signal does not reach the transmitter the test should be repeated automatically for atleast 5 trials and alarm should be given in case the test still fails.

It shall also be possible to initiate a loop test manually at any station by pressing a button on the front of the equipment.

Internal test routine shall continuously monitor the availability of the protection signaling equipment.

Proper tripping signal shall always take the priority over the test procedure.

The high speed digital protection signaling equipment shall be designed and provided with following features.

- shall employ latest digital signal processing technology.
- shall be able to monitor through same NMS of OLTE & MUX equipment. ie. Digital Tele-protection equipment shall be an integral part of OLTE & MUX eqpt. for the offered OLTE & MUX equipment.
- shall be provided with redundant power supply unit
- shall work in conjunction with PCM multiplexer
- it shall communicate on 64kbps channel preferably on V.11 or G.703.
- all I/Os electrically isolated
- full duplex operation
- permissive tripping
- direct tripping
- blocking, unblocking
- auto loop test facility shall be provided
- should meet IEC 834-1 standard
- shall provide an interface facility to connect handheld terminal or pc for indicating status, alarm messages, and transmission time etc.
- shall have the addressing facility
- shall able to transmit upto 8 commands in one 64 kbps channel
- transmission time shall be < 7ms.
- the tele protection eqpt. shall be able to programmed through handheld terminal / pc.
- the Teleprotection equipment shall have a visual contains.

2.0 Protection signalling equipment design

The Tele-protection equipment shall be of modular construction and shall be an integral part of the optical terminal multiplexer eqpt and shall be completely solid state using semiconductors, micro-processors and self-supervision, providing alarms in the case of equipment failure (TX / RX), absence of the guard frequency signal, power supply failure, etc.

The input/output interface to the protection equipment shall be by means of relays and the input/output rack wiring shall be carefully segregated from other shelf/cubicle wiring.

The isolation requirements of the protection interface shall be for 2 kv rms.

- 2.1 each tele-protection equipment shall be supplied with redundant power supply unit.
all command channels are operationally independent from each other and they meet the following performance characteristics:

- ❖ equipment operating time < 6 ms (8 channels)
- ❖ probability of missing command p_{mc} (at ber < 10^{-3}) < 10^{-9}
- ❖ mean time between unwanted commands

(at $t_{ses} < 0.005\%$ and $t_{es} < 0.1\%$) 100000 a

The error control procedure in the 64 kbit/s channel is based on the use of a block code specifically developed to be used for tele-protection signaling via telecommunication networks based on the ITU-T recommendations. the error control procedure includes a means to identify the origin of the incoming 64 kbits / s.

command-type Tele-protection applications are normally placed in three categories according to the nature of the information conveyed by the Tele-protection commands: permissive, blocking and inter-tripping schemes.

The Tele-protection signaling equipment shall be managed from network management system of primary multiplexer.

The Tele-protection equipment shall be provided with trip counters for both TX and RXcommands in the form of event register.

Main characteristics:

64 kbit/s interface :

The 64 kbit/s interface meets the requirements of the ITU-T recommendation G.703. both timing modes, co-directional and contra-directional, are provided.

Command interfaces:

Command inputs:

The command inputs should be galvanically isolated inputs, which generate internally the operating voltage for the input circuit.

- a) potential free contacts (via internal dc-dc converter with nominal operating voltage 24 VDC)
- b) operating current 10 ma
- c) wetting current 15 ma

Command outputs :

The command outputs should be galvanically isolated outputs. each output has one MOS-FET changeover contact.

- a) nominal operating voltage 250 VDC or AC
- b) maximum switching power 100 VA
- c) maximum switching current 1 A

Command interface-related requirements:

All interfaces with the protection relay logic comply with the following requirements of IEC 255 / IEC 834-1.

Command inputs:

Insulation resistance >100 mohm (measured at the voltage of 500 VDC)

- A) isolation voltage test voltage 1 kV AC / 1 minute
- B) impulse test voltage 1.2/50 ms 2 kv (differential and common mode)
- C) high frequency disturbance test 1.0 kv (differential mode)
- D) high frequency disturbance test 2.5 kv (common mode)

Command outputs:

- A) insulation resistance >100 mohm (measured at the voltage of 500 VDC)
- B) isolation voltage test voltage 2 kv AC / 1 minute
- C) impulse test voltage 1.2/50 ms 2 kv (common mode)
- D) high frequency disturbance test 2.5 kv (common mode)

Operating voltages: -20 to -70 VDC

**GUARANTEED TECHNICAL PARTICULARS FOR
DIGITAL TELEPROTECTION COUPLER (DTPC) EQUIPMENT:**

1. Make &Model :
 2. Commands capacity :
 3. Compatible to Optical Equipment : Yes / No
 4. Type of Command Input Interfacing :
 5. Type of Command output Interfacing:
 6. No. of commands capability :
 7. Type of Trip counters (event registers) :
 8. Power Supply redundancy : Yes / No
 9. Operating time for Protection couplers:
 10. Interfacing through Potential free contacts: Yes / No
 11. Monitoring through MUX NMS for the DTPCs offered.
 12. Whether the offered DTPCs are an integral part of OLTE/MUX eqpt.
-
-

TENDERER

SIGNATURE OF THE

**GUARANTEED TECHNICAL PARTICULARS for OPTICAL LINE
TERMINATION EQUIPMENT (OLTE) SDH STM-4**

Manufacturer:

Model :

| S.No | Technical parameter | Unit | Particulars |
|------|---|---|-------------|
| 1. | Capacity Aggregate Bit-rate: CEPT E-1 Ports: | Mbps nxE1 nx10/100 Ethernet ports | |
| 2. | Cross connect redundancy | Yes / No | |
| 3 | Control unit redundancy | Yes / No | |
| 4. | Protection OLTE = 1:1 APS E-1 Ports = 1:1 APS | Yes / No | |
| 5. | Unprotected System Gain for BER 10 ⁻³ : BER 10 ⁻⁶ : | DBm | |
| 6. | 1 + 1 APS System Gain for BER 10 ⁻³ : BER 10 ⁻⁶ : | DBm | |
| 7. | MTBF Unprotected: 1+1APS Protected: | Hours | |
| 8. | Code Format: | | |
| 9. | List Optical Coupling options: | | |

OPTICAL TRANSMITTER:

| | | | |
|-----|--|-----|--|
| 10. | Source (LED or Laser) | | |
| 11. | Source wavelength: | Nm | |
| 12. | Source spectral width: | Nm | |
| 13. | Mean launched power Maximum: Nominal: | dBm | |
| 14. | Launch power during safety Power-down due to fibre break: | dBm | |

| | | | |
|-----|--|-------|--|
| 15. | Stability (nominal power variation due to temperature and/or biasing): | % | |
| 16. | Source rise time: | | |
| 17. | Source estimated life span: | Hours | |
| 18. | Source extinction ratio: | | |
| 19. | Low power alarm Threshold: field adjustable | | |

| optical receiver: | | | |
|---|---|--------|--|
| 20. | Nominal receive signal strength: | dBm | |
| 21 | Receiver Threshold BER 10-6: BER 10-9: | dBm | |
| 22 | Receiver overload limit: | dBm | |
| 23 | Spectral Bandwidth (3 Db point): | Nm | |
| 24 | Digital Bandwidth: | mbps | |
| 25 | Signal-to-noise @ center wavelength: @ 3 dB points: | | |
| 26 | AGC range: | | |
| SERVICE CHANNELS AND ORDER WIRE UNIT Engineering Orderwire | | | |
| 27 | Omnibus calling available Describe: | Yes/No | |
| 28 | Selected station calling available? Describe: | Yes/No | |
| 29 | Signalling scheme Describe: | | |
| 30 | Tx/Rx level | DBm | |
| 31 | Speech coding method & bit rate | Kbit/s | |
| 31 | Distortion: Noise performance: | S/N | |

Date:

Signature:

Place:

Name:

Seal:

Designation:

GUARANTEED TECHNICAL PARTICULARS for Multiplexer

| S.No | Technical parameter | Unit | Particulars |
|---|--|-------------|--------------------|
| Voice Channels | | | |
| 1 | Are Service channel requirements specified met? | Yes/No | |
| 2 | No. of VF Channels: | Ea | |
| 3 | Pass band: | KHz | |
| 4 | Subscriber side interface: | | |
| 5 | Input & Output level | dBm | |
| 6 | Idle channel noise | DBmOp | |
| 7 | Distortion: | | |
| Data and Supervisory Channel | | | |
| 8 | No of data channels: | Ea | |
| 9 | Interfaces/Connectors: | | |
| 10 | Data rates: | Kbps | |
| ELECTRICAL INPUT/OUTPUT INTERFACES | | | |
| 11 | List ITU-T Standards in compliance With: | | |
| 12 | Tributary bit rate (nominal): | Mbit/s | |
| 13 | Tolerance in bit rate: | Ppm | |
| 14 | Line code: | | |
| 15 | No. of ports: | | |
| 16 | Impedance of coax cable used for Input/Output port: | ohms | |
| 17 | Type of Connector | | |
| 18 | Input jitter acceptance 100 Hz to 10 KHz: 10 KHz to 800 KHz: | UI (p-p) | |
| 19 | Maximum output jitter in the absence of i/p jitter | UI (p-p) | |

| | | | |
|----|--|--|--|
| | 100 Hz to 10 KHz: 10KHz to 800 KHz: UI (p-p) | | |
| 20 | Jitter transfer characteristic: | | |

| OUTPUT PORT | | | |
|--------------------|--|--------------------------|--|
| 21 | Line impedance Balanced: Unbalanced: | <input type="checkbox"/> | |
| 22 | Test load impedance (Unbalanced): | <input type="checkbox"/> | |
| 23 | Peak pulse amplitude (nominal + tolerance): | V dc | |
| 24 | Pulse width (nominal + tolerance): | Ns | |
| 25 | Ratio of +ve & -ve pulses at the center of a pulse interval | | |
| 26 | Ratio of width of +ive & -ive pulses at nominal half Amplitude | | |
| 27 | Maximum insertion loss | dB | |

| INPUT PORT | | | |
|-------------------|--|----|--|
| 28 | Attenuation Char. of inter-connecting cable for digital signal presented at input port | | |
| 29 | Return loss (at 1.024 MHz) | dB | |
| 30 | Admissible i/p signal attenuation | dB | |
| 31 | Cable loss Equalization Range | dB | |
| 32 | Maximum insertion loss | dB | |

Date:

Signature:

Place:

Name :

Seal:

Designation:

| GUARANTEED TECHNICAL PARTICULARS for OPTICAL LINE TERMINATION EQUIPMENT (OLTE) SDH STM-4 | | | |
|---|---|----------------------------|-------------|
| PROTECTION SWITCHING | | | |
| S.No | Technical parameter | Unit | Particulars |
| 1 | Switching modes available Auto? Manual? Remote/network management? | Yes/No | |
| 2 | Switching priority: | | |
| 3 | Tx switchover & switchback criteria: | | |
| 4 | Rx switchover & switchback criteria: | | |
| 5 | Inbuilt Mux (if applicable) switchover & switchback criteria: | | |
| 6 | Switch option mode & status indicators: | | |
| MECHANICAL AND ENVIRONMENTAL PARAMETERS | | | |
| 7 | Number of chassis (including, DC/DC converters, O/W muldem etc.,) required for Unprotected Terminal: I: 1 Protected Terminal | | |
| 8 | Chassis Dimensions (L *W*H): | cm | |
| 9 | Chassis Weight: | Kg | |
| 10 | Chassis mounting options: | | |
| 11 | Chassis clearance requirements Top * Bottom * Sides: Front Access: Rear Access: | m | |
| 12 | Chassis colour and finish | | |
| S.No | Technical parameter | Unit | Particulars |
| 13 | Rack options available 19" ETSI? Slim rack? Others (specify)? | Yes/No Yes/No Yes/No | |

| | | | |
|----|------------------------------|--|--|
| 14 | Protection Class (IP Class): | | |
| 15 | Rack Colour and Finish: | | |

| | | | |
|----|--|----|--|
| 16 | Temperature range Guaranteed performance: Operation without damage: Storage/ transport: | °C | |
| 17 | Relative humidity Minimum: Maximum: | % | |
| 18 | Altitude Installed: Transport/storage: | M | |
| 19 | Describe Ventilation requirements: | | |
| 20 | Describe dust proofing provisions: | | |
| 21 | Electromagnetic compatibility (List standards & severity levels) | | |

Date:

Signature:

Place:

Name:

Seal:

Designation:

| GUARANTEED TECHNICAL PARTICULARS for OPTICAL LINE TERMINATION EQUIPMENT (OLTE) SDH STM-4 | | | |
|---|---|---------|-------------|
| POWER supply unit (dc/dc converter) | | | |
| Manufacturer: | | | |
| Model name : | | | |
| S.No | Technical parameter | Unit | Particulars |
| 1. | Nominal supply voltage: | Vdc | |
| 2. | Power supply variation Guaranteed performance: Operation without damage: | Vdc | |
| 3. | Polarity: | +/- | |
| 4. | POWER Supply redundancy | YES /NO | |
| 5. | List derived DC voltages: | Vdc | |
| | Total power consumption (Fully equipped incl. Service channels) Unprotected terminal: 1+1 Protected terminal: | Watt | |
| 6. | 1+1 APS protection provided? | Yes/No | |
| 7. | MTBF of Power supply unit: | Hours | |
| 8. | Ultimate Power delivery capacity | Watt | |
| 9. | Ultimate Power delivery capacity | Watt | |
| 10. | Are the following protections Provided Over voltage? Under voltage? Overload? Reverse polarity? Other(specify)? | Yes | |

Date:

Signature:

Place:

Name:

Seal:

Designation:

**GUARANTEED TECHNICAL PARTICULARS for OPTICAL LINE
TERMINATION EQUIPMENT (OLTE) SDH STM-4**

Main Distribution Frames

Manufacturer:

Model name :

| S.No | Technical parameter | Unit | Particulars |
|------|---|----------------------|-------------|
| 1. | Dimensions Height: Width: Depth: | Cm cm cm | |
| 2. | Weight; | Kg | |
| 3. | Colour and Finish: | | |
| 4. | Method(s) of Mounting | | |
| 5. | Clearances required for Installation: Ceiling: From: Rear: | mtr. mtr. mtr. | |
| 6. | Cable entry(s): | | |
| 7. | Cable Glanding: | | |
| 8. | Frame material & Guage: | | |
| 9. | Locking Arrangement | | |
| 10. | Frame capacity: Number of Horizontal Rows: Number of Vertical Rows: Number of Terminal Blocks per Row: | Each | |
| 11. | Provide details on installation, cabling, cross connections and patching facilities (if any) | | |

Date:

Place:

Seal:

Signature:

Name:

Designation:

| GUARANTEED TECHNICAL PARTICULARS for OPTICAL LINE TERMINATION EQUIPMENT (OLTE) SDH STM-4 | | | |
|---|---|--|-------------|
| Digital Distribution Frames | | | |
| S.No | Technical parameter | Unit | Particulars |
| 1. | Dimensions Height: Width: Depth: | cm cm cm | |
| 2. | Weight; | Kg | |
| 3. | Colour and Finish: | | |
| 4. | Method(s) of Mounting | | |
| 5. | Clearances required for Installation: Ceiling: From: Rear: | mtr. mtr. mtr. | |
| 6. | Cable entry(s): | | |
| 7. | Cable Glanding: | | |
| 8. | Frame material & Guage: | | |
| 9. | Locking Arrangement | | |
| 10. | Frame capacity: (No. of co-axial panels) | Each | |
| 11. | Co-axial panel capacity: (Number of PCM Systems) | Each | |
| 12 | No. of E1s termination capacity | | |
| 13. | Co-axial connectors: Type: Characteristic impedance: Return loss (up to 90 MHz): Transfer impedance: Test voltage (1 Minute): Maximum current rating: | <input type="checkbox"/> dB <input type="checkbox"/> V A | |

13. Provide details on installation, cabling, cross connections and patching facilities (if any).

Date:
Place:
Seal:

Signature:
Name:
Designation:

STATION WISE BILL OF MATERIAL FOR IMPORTANT CARDS

| Sl.no. | Description | | |
|--------|---|--|--|
| 1 | STM-4 optical line cards for 1+1 | | |
| 2 | Control unit cards | | |
| 3 | Cross connect cards | | |
| 4 | Power supply cards | | |
| 5 | 32 x E1 trib. Cards | | |
| 6 | 8 x 10/100 mbps Eth cards | | |
| 7 | 4w E&M cards | | |
| 8 | Hot line cards | | |
| 9 | V.24 I/F cards | | |
| 10 | V.11 I/F cards | | |
| 11 | G.703 I/F cards | | |
| 12 | V.35 I/F cards | | |
| 13 | Channel I/F card for DTPCs | | |
| 14 | Ext. Alarm I/F cardsS | | |
| 15 | Any other cards needed to meet spec. Requirement. | | |

Date:

Signature:

Place:

Name:

Seal:

Designation:

List of mandatory spares for OLTE / MUX

| Sl.no. | Description | Quantity |
|--------|--|----------|
| 1 | Stm-4 optical line cards for 1+1 | |
| 2 | Control unit cards | |
| 3 | Cross connect cards | |
| 4 | Power supply cards | |
| 5 | 32 x E1 trib. Cards | |
| 6 | 8 x 10/100 mbps eth cards | |
| 7 | 4w E&M cards | |
| 8 | Any other cards needed to meet spec. Requirement as a mandatory spare | |

Date:

Signature:

Place:

Name:

Seal:

Designation:

List of mandatory spares for Digital Teleprotection equipment

| Sl.no. | Description | Quantity |
|--------|---|----------|
| 1. | Control unit cards | |
| 2. | Power supply cards | |
| 3. | Channel interface card. | |
| 4 | Any other cards needed to meet spec. Requirement as a mandatory spare | |

Date:

Signature:

Place:

Name:

Seal:

Designation:

SPECIFICATIONS FOR OPGW CABLING & ASSOCIATED HARDWARE & FITTINGS

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SECTION – 1

OPGW CABLING AND ASSOCIATED HARDWARE & FITTINGS

This section describes the functional & technical specifications of OPGW cabling and associated hardware & fittings.

1.1 FIBRE OPTIC CABLING

This section defines the requirements for G.652D & G655 Dual-window Single mode (DWDM) telecommunication grade Fibre optic. Bidders shall furnish with their bids, detailed descriptions of the Fibres & cable (s) proposed.

All optical Fibre cabling including fibre itself and all associated installation hardware shall have a minimum guaranteed design life span of 25 years. Documentary evidence in support of guaranteed life span of cable & Fibre shall be submitted by the Contractor during detailed engineering.

1.1.1 REQUIRED OPTICAL FIBRE CHARACTERISTICS

This section describes the characteristics of optical fibre to be provided under this specification.

1.1.1.1 PHYSICAL CHARACTERISTICS

Dual-Window Single mode (DWDM), G.652D optical fibres shall be provided in the fibre optic cables. DWDM optical fibres shall meet the requirements defined in Table 2-1 (a).

1.1.1.2 ATTENUATION

The attenuation coefficient for wavelengths between 1525 nm and 1575 nm shall not exceed the attenuation coefficient at 1550 nm by more than 0.05 db. the attenuation coefficient between 1285 nm and 1330 nm shall not exceed the attenuation coefficient at 1310 nm by more than 0.05 db. the attenuation of the fibre shall be distributed uniformly throughout its length such that there are no point discontinuities in excess of 0.10 db. the fibre attenuation characteristics specified in table 2-1 (a) shall be “guaranteed” fibre attenuation of any & every fibre reel.

the overall optical fibre path attenuation shall not be more than calculated below:

maximum attenuation @ 1550nm: $0.21 \text{ db/km} \times \text{total km} + 0.05 \text{ db/splice} \times \text{no. of splices} + 0.5 \text{ db/connector} \times \text{no. of connectors}$.

maximum attenuation @ 1310nm: $0.35 \text{ db/km} \times \text{total km} + 0.05 \text{ db/splice} \times \text{no. of splices} + 0.5 \text{ db/connector} \times \text{no. of connectors}$.

Table 2-1 (a)
DWSM OPTICAL FIBRE CHARACTERISTICS

| | |
|--|--|
| Fibre description: | Dual-window single-mode |
| Mode field diameter: | 8.6 to 9.5 μm ($\pm 0.6 \mu\text{m}$) |
| Cladding diameter: | 125.0 $\mu\text{m} \pm 1 \mu\text{m}$ |
| Model field concentricity error | $\leq 0.6 \mu\text{m}$ |
| Cladding non-circularity | $\leq 1\%$ |
| Cable cut-off wavelength λ_{cc} | $\leq 1260 \text{ nm}$ |
| 1550 nm loss performance | As per g.652 d |
| Proof test level | $\geq 0.69 \text{ gpa}$ |
| Attenuation coefficient: | $\begin{array}{ll} @ 1310 \text{ nm} & \leq 0.35 \text{ db/km} \\ @ 1550 \text{ nm} & \leq 0.21 \text{ db/km} \end{array}$ |
| Chromatic dispersion; maximum: | 18ps/(nm x km) @ 1550 nm 3.5 ps/(nm x km) 1288-1339 nm 5.3 ps/(nm x km) 1271-1360 nm |
| Zero dispersion wavelength: | 1300 to 1324 nm |
| Zero dispersion slope: | 0.092 ps/(nm ² xkm) maximum |
| Polarization mode dispersion coefficient | $\leq 0.2 \text{ ps/km}^{1/2}$ |
| Temperature dependence: | Induced attenuation $\leq 0.05 \text{ db}$ (-60°C - +85°C) |
| Bend performance: | $\begin{array}{l} @ 1310 \text{ nm } (75 \pm 2 \text{ mm dia mandrel}), 100 \text{ turns:} \\ \quad \text{Attenuation rise } \leq 0.05 \text{ db} \\ @ 1550 \text{ nm } (30 \pm 1 \text{ mm radius mandrel}), 100 \text{ turns:} \\ \quad \text{Attenuation rise } \leq 0.05 \text{ db} \\ @ 1550 \text{ nm } 32 \pm 0.5 \text{ mm dia mandrel, 1 turn;} \\ \quad \text{Attenuation rise } \leq 0.50 \text{ db} \end{array}$ |

1.1.2 FIBRE OPTIC CABLE CONSTRUCTION

Overhead Fibre Optic Cables shall be OPGW (Optical Ground Wire). The OPGW cable is proposed to be installed on transmission lines. The design of cable shall account for the varying operating and environmental conditions that the cable shall experience while in service.

1.1.2.1 TRANSMISSION LINE DETAILS

Typical details of transmission lines are indicated in the appendices. Any other details, as required for cable design etc, shall be collected by the contractor during survey.

1.1.2.2 OPTICAL FIBRE CABLE LINK LENGTHS

The estimated optical fibre link lengths are provided in Appendices. However, the Contractor shall supply & install the optical fibre cable as required based on detailed site survey to be carried out by the Contractor during the project execution. The Contract price shall be adjusted accordingly.

For the purpose of payment, the optical fibre link lengths are defined as transmission line route lengths from Gantry at one terminating station to the Gantry in the other terminating station. The actual cable lengths to be delivered shall take into account various factors such as sag, service loops, splicing, working lengths & wastage etc, and no additional payment shall be payable in this regard. The unit rate for FO cable quoted in the Bid price Schedules shall take into account all such factors.

1.1.2.3 Optical Fibre Identification

Individual optical fibres within a fibre unit and fibre units shall be identifiable in accordance with EIA/TIA 598 OR IEC 60304 or Bellcore GR-20 colour-coding scheme.

Colouring utilized for colour coding optical fibres shall be integrated into the fibre coating and shall be homogenous. The colour shall not bleed from one fibre to another and shall not fade during fibre preparation for termination or splicing.

Each cable shall have traceability of each fibre back to the original fibre manufacturer's fibre number and parameters of the fibre. If more than the specified number of fibres are included in any cable, the spare fibres shall be tested by the cable manufacturer and any defective fibres shall be suitably bundled, tagged and identified at the factory by the vendor.

1.1.2.4 Buffer Tube

Loose tube construction shall be implemented. The individually coated optical fibre(s) shall be surrounded by a buffer for protection from physical damage during fabrication, installation and operation of the cable. The fibre coating and buffer shall be strippable for splicing and termination. Each fibre unit shall be individually identifiable utilizing colour coding. Buffer tubes shall be filled with a water-blocking gel.

1.1.2.5 Optical Fibre Strain & Sag-tension chart

The fibre optic cable shall be designed and installed such that the optical fibres experience no strain under all loading conditions defined in IS 802. Zero fibre strain condition shall apply even after a 25 year cable creep.

For the purpose of this specification, the following definitions shall apply;

- Maximum Working Tension (MWT) is defined as the maximum cable tension at which there is no fibre strain.
- The no fibre strain condition is defined as fibre strain of less than or equal to 0.05%, as determined by direct measurements through IEC/ETSI(FOTP) specified optical reflectometry techniques.

- The Cable strain margin is defined as the maximum cable strain at which there is no fibre strain.
- The cable Maximum Allowable Tension (MAT) is defined as the maximum tension experienced by the Cable under the worst case loading condition.
- The cable max strain is defined as the maximum strain experienced by the Cable under the worst case loading condition
- The cable Every Day Tension (EDT) is defined as the maximum cable tension on any span under normal conditions.
- The Ultimate / Rated Tensile Strength (UTS/RTS/breaking strength) is defined as the maximum tensile load applied and held constant for one minute at which the specimen shall not break.

While preparing the Sag-tension charts for the OPGW cable the following conditions shall be met:

- The Max Allowable Tension (MAT) / max strain shall be less than or equal to the MWT/Strain margin of the cable
- The Sag shall not exceed the earth wire sag in all conditions.
- The Max Allowable Tension shall also be less than or equal to 0.4 times the UTS.
- The 25 years creep at 25% of UTS (creep test as per IEEE 1138) shall be such that the 25 years creep plus the cable strain at Max Allowable Tension (MAT) is less than or equal to the cable strain margin.
- The everyday tension (EDT) shall not exceed 20% of the UTS for the OPGW cable.

The Sag-tension chart of OPGW cable indicating the maximum tension, cable strain and sag shall be calculated and submitted along with the bid under various conditions mentioned below:

1. 53°C, no wind and no ice
2. 32°C, no wind and no ice
3. 0°C, no wind and no ice
4. 32°C, full wind and no ice
5. 32°C, 75% full wind and no ice
6. 0°C, 2/3rd / 36% of full wind (IS 802:1977/1995)

The above cases shall be considered for the spans from 100 m to 600 m or higher span length in the range of 50 m spans. Max. vertical sag, max. tension and max sag at 0° C & no wind shall be considered for in line with the design parameter of transmission line. The typical details are indicated in the appendices. The full wind load shall be considered as the design wind load for all the specified transmission lines as per relevant IS 802 version and the sag-tension chart shall be submitted considering the transmission lines. The contractor shall submit the stringing chart for review of Employer.

1.1.2.6 Cable Materials

The materials used for optical fibre cable construction, shall meet the following requirements:

1.1.2.6.1 Filling Materials

The interstices of the fibre optic unit and cable shall be filled with a suitable compound to prohibit any moisture ingress or any water longitudinal migration within the fibre optic unit or along the fibre optic cable. The water tightness of the cable shall meet or exceed the test

performance criteria as per IEC-794-1-F-5.

The filling compound used shall be a non-toxic homogenous waterproofing compound that is free of dirt and foreign matter, nonhygroscopic, electrically nonconductive and non-nutritive to fungus. The compound shall also be fully compatible with all cable components it may come in contact with and shall inhibit the generation of hydrogen within the cable.

The waterproofing filling materials shall not affect fibre coating, colour coding, or encapsulant commonly used in splice enclosures, shall be dermatologically safe, non-staining and easily removable with a non-toxic cleaning solvent.

1.1.2.6.2 Metallic Members

When the fibre optic cable design incorporates metallic elements in its construction, all metallic elements shall be electrically continuous.

1.1.2.6.3 Marking, Packaging and Shipping

This section describes the requirements for marking, packaging and shipping the overhead fibre optic cable.

- (a) Drum Markings: Each side of every reel of cable shall be permanently marked in white lettering with the vendors' address, the Purchaser's destination address, cable part number and specification as to the type of cable, length, number of fibres, a unique drum number including the name of the transmission line & segment no., factory inspection stamp and date.
- (b) Cable Drums: All optical fibre cabling shall be supplied on strong drums provided with lagging of adequate strength, constructed to protect the cabling against all damage and displacement during transit, storage and subsequent handling during installation. Both ends of the cable shall be sealed as to prevent the escape of filling compounds and dust & moisture ingress during shipment and handling. Spare cable caps shall be provided with each drum as required.

The spare cable shall be supplied on sturdy, corrosion resistant, steel drums suitable for long periods of storage and re-transport & handling.

There shall be no factory splices allowed within a continuous length of cable. Only one continuous cable length shall be provided on each drum. The lengths of cable to be supplied on each drum shall be determined by a "schedule" prepared by the Contractor.

1.1.2.6. OPGW cable Installation requirements

Most of the OPGW fibre optic cables to be installed under this project shall be installed under live line conditions, i.e. with all the circuits of the transmission line charged to their rated voltage. However, some of OPGW cables may be installed in off-line conditions. The tentative bill of quantities for both live-line as well as off-line OPGW cable system installations have been specified in the appendices and the actual quantities for both types shall be finalized during project execution after detailed survey.

Under live line installation, the OPGW cable shall be installed on transmission lines under live line conditions, i.e. with all the circuits of the transmission line charged to their rated voltage.

The OPGW cable shall be installed at the top of the tower by replacing the existing ground wire. The contractor shall carry out re-tensioning of existing earth wire wherever required to maintain the adequate clearances for live line stringing of fibre optic cables. However, in exceptional cases installation of OPGW cable below conductor may also be considered on low voltage lines which shall be decided during detailed engineering.

For new Transmission line, the stringing of OPGW cable shall be carried out by Transmission Line Tower Package Contractor(s) as per the stringing chart/procedure submitted by them and approved by Employer. The splicing work shall be carried out by Communication system Package Contractor. All hardware & fitting needed to tie the OPGW to the towers/gantries shall be provided by Communication system Package Contractor to the transmission line tower contractor.

While handing over the OPGW drums, the testing (fibre loss and length measurement using OTDR) of OPGW in each drum shall be carried out by Communication system Package Contractor in presence of Tower package contractor(s) and Employer representative. After installation of OPGW cable, the testing of each section shall be carried out again by the Communication system Package contractor in presence of Tower package contractor(s) and Employer representative. In case of any damage/ high loss in the fibre, the total length of that particular section of OPGW cable shall be replaced by Tower package contractor(s), Communication system Package Contractor shall supply new OPGW cable in place of damaged cable. The Contract price shall be adjusted accordingly.

Supervision of Installation – The Contractor shall supervise the stringing at site as per the approved stringing procedure. Site visit for supervision shall be carried out as per instruction of Employer. The mandays for site supervision is identified in Appendix. However, the contract price shall be adjusted as per the actual requirement. The Supervision/Inspection work in Contractor's scope shall mainly include inspection as per stringing procedure, proper location of drum site, installation of stringing blocks/pulleys, proper sagging, proper installation of hardware, proper tension as per Sag-Tension chart, provision of service loops of OPGW in jointing locations etc.

1.1.2.7 Optical Ground Wire (OPGW)

OPGW cable construction shall comply with IEEE-1138, 1994. The cable provided shall meet both the construction and performance requirements such that the ground wire function, the optical fibre integrity and optical transmission characteristics are suitable for the intended purpose. The cable shall consist of optical fibre units as defined in this specification. There shall be no factory splices within the cable structure of a continuous cable length.

The composite fibre optic overhead ground wire shall be made up of buffered optical fibre units (fibres in the buffer tube) embedded in a water tight aluminimum / aluminium alloy / stainless steel protective central fibre optic unit surrounded by concentric-lay stranded metallic wires in single or multiple layers. The dual purpose of the composite cable is to provide the electrical and physical characteristics of conventional overhead ground wire while providing the optical transmission properties of optical fibre.

1.1.2.7.1 Central Fibre Optic Unit

The central fibre optic unit shall be designed to house and protect multiple buffered optical

fibres units from damage due to forces such as crushing, bending, twisting, tensile stress and moisture. The central fibre optic unit and the outer stranded metallic conductors shall serve together as an integral unit to protect the optical fibres from degradation due to vibration and galloping, wind and ice loadings, wide temperature variations, lightning and fault current, as well as environmental effects which may produce hydrogen.

The OPGW design of dissimilar materials such as stainless steel tube with aluminium or aluminium – clad – steel wire strands are not allowed. Central fibre optic unit may be of aluminium or stainless steel tube with aluminium protective coating. In case of aluminium protective coating, the coating must completely cover the tubes leaving no exposed areas of tubing that can make electrical contact either directly or indirectly through moisture, contamination, protrusions, etc with the surrounding stranded wires. The tube may be fabricated as a seamless tube, seam welded, or a tube without a welded seam.

1.1.2.7.2 Breaking Strength

The rated breaking strength of the completed OPGW shall be taken as no more than 90 percent of the sum of the rated breaking strengths of the individual wires, calculated from their nominal diameter and the specified minimum tensile strength.

The rated breaking strength shall not include the strength of the optical unit. The fibre optic unit shall not be considered a load bearing tension member when determining the total rated breaking strength of the composite conductor.

1.1.2.7.3 Electrical and Mechanical Requirements

Table 2-2(a) provides OPGW Electrical and Mechanical Requirements for the minimum performance characteristics. Additionally, the OPGW mechanical & electrical characteristics shall be similar to that of the earthwire being replaced such that there is no or minimal consequential increase in stresses on towers. For the purpose of determining the appropriate Max Working Tension limit for the OPGW cable **IS 802:1995 and IS 875:1987** shall be applied. However the OPGW installation sag & tension charts shall be based on **IS 802** version to which the line is originally designed. For the OPGW cable design selection and preparation of sag tension charts, the limits specified in this section shall also be satisfied. The Bidder shall submit sag-tension charts for the above cases with their bids.

Table 2.2(a)
OPGW Electrical and Mechanical Requirements

| | | |
|-----|--------------------------|---------------------------------|
| (1) | Everyday Tension | <u>< 20% of UTS of OPGW</u> |
| (2) | D.C. Resistance at 20°C: | <u>< 1.0 ohm/Km</u> |
| (3) | Short Circuit Current: | <u>≥ 6.32 kA for 1.0 second</u> |

1.1.2.7.4 Operating conditions

Since OPGW shall be located at the top of the EHV transmission line support structure, it will be subjected to Aeolian vibration, Galloping and Lightning strikes. It will also carry ground fault currents. Therefore, its electrical and mechanical properties shall be same as those required of conventional ground conductors.

1.1.2.7.5 Installation

OPGW installed under live line condition, i.e. with all circuits charged to the rated line voltage as specified in this section shall be generally in accordance with the IEEE Guide to the Installation of Overhead Transmission Line Conductors (IEEE STD. 524 with latest revisions), with additional instructions and precautions for live line working and fibre optic cable handling. The stringing procedure shall be submitted by the Contractor prior to stringing for Employer's approval.

A tower structural analysis shall be carried out by the Contractor, based on the relevant data to be provided by Employer, to ensure that with the replacement of existing earthwire with the OPGW cable, the tower members remain within the statutory safety limits as per Indian Electricity rules and if required the Contractor shall carry out the tower strengthening as necessary. The OPGW cable sections shall normally be terminated & spliced only on tension towers. In exceptional circumstances, and on Employer specific approval, cable may be terminated on Suspension towers, but in this case tower strength shall be examined to ensure that tower loads are within safe limits and if required, necessary tower strengthening shall be carried out by the Contractor.

1.1.2.7.6 Installation Hardware

The scope of supply of the optical cable includes the assessment, supply and installation of all required fittings and hardware such as Tension assembly, Suspension assembly, Vibration dampers, Reinforcing rods, Earthing clamps, Downlead clamps, splice enclosure etc. The Bidder shall provide documentation justifying the adequacy and suitability of the hardware supplied. The Contractor shall determine the exact requirements of all accessories required to install and secure the OPGW.

The OPGW hardware fittings and accessories shall follow the general requirements regarding design, materials, dimensions & tolerances, protection against corrosion and markings as specified in clause 4.0 of EN 61284:1997 (IEC 61284). The shear strength of all bolts shall be at least 1.5 times the maximum installation torque. The OPGW hardware & accessories drawing & Data Requirement Sheets (DRS) document shall consist of three parts: (1) A technical particulars sheet (2) An assembly drawing i.e. level 1 drawing and (3) Component level drawings i.e. level 2 & lower drawings. All component reference numbers, dimensions and tolerances, bolt tightening torques & shear strength and ratings such as UTS, slip strength etc shall be marked on the drawings.

The fittings and accessories described herein are indicative of installation hardware typically used for OPGW installations and shall not necessarily be limited to the following:

- (a) Suspension Assemblies: Preformed armour grid suspension clamps and aluminium alloy armour rods/reinforcing rods shall be used. The suspension clamps shall be designed to carry a vertical load of not less than 25 KN. The suspension clamps slippage shall occur between 12kN and 17kN as measured in accordance with type test procedures specified in Appendix, Vol.II.

The Contractor shall supply all the components of the suspension assembly including shackles, bolts, nuts, washers, split pins, etc. The total drop of the suspension assembly shall not exceed 150 mm (measured from the center point of attachment to the center point of the OPGW). The design of the assembly shall be such that the direction of run of the OPGW shall be the same as that of the conductor.

- (b) Dead End Clamp Assemblies: All dead end clamp assemblies shall preferably be of performed armoured grip type and shall include all necessary hardware for attaching the assembly to the tower strain plates. Dead end clamps shall allow the OPGW to pass through continuously without cable cutting. The slip strength shall be rated not less than 95% of the rated tensile strength of the OPGW.
- (c) Clamp Assembly Earthing Wire: Earthing wire consisting of a 1500 mm length of aluminium or aluminium alloy conductor equivalent in size to the OPGW shall be used to earth suspension and dead end clamp assemblies to the tower structure. The earthing wire shall be permanently fitted with lugs at each end. The lugs shall be attached to the clamp assembly at one end and the tower structure at the other.
- (d) Structure Attachment Clamp Assemblies: Clamp assemblies used to attach the OPGW to the structures, shall have two parallel grooves for the OPGW, one on either side of the connecting bolt. The clamps shall be such that clamping characteristics do not alter adversely when only one OPGW is installed. The tower attachment plates shall locate the OPGW on the inside of the tower and shall be attached directly to the tower legs/cross – members without drilling or any other structural modifications.
- (e) Vibration Dampers: Vibration dampers type 4R Stockbridge or equivalent, having four (4) different frequencies spread within the Aeolian frequency bandwidth, shall be used for suspension and tension points in each span. The Contractor shall determine the exact numbers and placement(s) of vibration dampers through a detailed vibration analysis as specified in technical specifications. Vibration damper clamps shall be made of aluminium or aluminium alloy, shall support the dampers during installation and shall maintain the dampers in position without damage to the OPGW and without causing fatigue. Armour or patch rods made of aluminium or aluminium alloy shall be provided as required to reduce clamping stress on the OPGW. The vibration damper body shall be hot-dip galvanized mild steel/cast iron or shall be permanent mould cast zinc alloy.

1.1.3 Fibre Optic Splice Enclosures (Joint Box)

All splices shall be encased in Fibre Optic Splice Enclosures. Suitable splice enclosures shall be provided to encase the optical cable splices in protective, moisture and dust free environment. Splice enclosures shall comply to ingress protection class IP 66 or better. The splice enclosures shall be designed for the storage and protection of required number of optical fibre splices and equipped with sufficient number of splice trays for splice trays for splicing all fibres in the cable. No more than 6 fibres shall be terminated in a single splice tray. They shall be filled with suitable encapsulate that is easily removable should re-entry be required into the enclosures.

Splice enclosures shall be suitable for outdoor use with each of the cable types provided under this contract. Splice enclosures shall be appropriate for mounting on transmission line towers above anti-climb guard levels at about 10 metres from top of the tower and shall accommodate pass-through splicing. The actual mounting height and location shall be finalized after Survey. Contractor shall be responsible for splicing of fibres and installation of splice enclosures.

1.1.3.1 Optical Fibre Splices

Splicing of the optical fibre cabling shall be minimized through careful contractor planning. There shall be no mid-span splices allowed. All required splices shall be planned to occur on tower structures. All optical fibre splicing shall comply with the following:

- (a) All fibre splices shall be accomplished through fusion splicing.
- (b) Each fibre splice shall be fitted with a splice protection sheath fitted over the final splice.
- (c) All splices and bare fibre shall be neatly installed in covered splice trays. No more than six (6) fibres shall be installed in each splice tray.
- (d) For each link, bi-directional attenuation of single mode fusion splices, shall not average more than 0.05 dB and no single splice loss shall exceed 0.1 dB when measured at 1550 nm.
- (e) For splicing, fibre optic cable service loops of adequate length shall be provided so that all splices occurring at tower structures can be performed at ground level.

1.1.4 Fibre Optic Approach Cables

For purposes of this specification, a fibre optic approach cable is defined as the Armoured underground fibre optic cable required to connect Overhead Fibre Optic Cable (OPGW) between the final in line splice enclosure on the gantry / tower forming the termination of the fibre cable on the power line and the Fibre Optic Distribution Panel (FODP) installed within the building. The estimated fibre optic approach cabling length requirements are indicated in the appendices. However, the Contractor shall supply & install the optical fibre approach cable as required based on detailed site survey to be carried out by the Contractor during the project execution and the Contract price shall be adjusted accordingly.

1.1.4.1 Basic Construction

The cable shall be suitable for direct burial, laying in trenches & PVC/Hume ducts, laying under false flooring and on indoor or outdoor cable raceways.

1.1.4.2 Jacket Construction & Material

The approach cable shall be a UV resistant, rodent proof, armoured cable with metallic type of armoring. The outer cable jacket for approach cable shall consist of carbon black polyethylene resin to prevent damage from exposure to ultra-violet light, weathering and high levels of pollution. The jacket shall confirm to ASTM D1248 for density.

1.1.4.3 Optical, Electrical and Mechanical Requirements

Approach cable shall contain fibres with identical optical/physical characteristics a those in the OPGW cables. The cable core shall comprise of tensile strength member(s), fibre support/bedding structure, core wrap/bedding, and an overall impervious jacket.

1.1.5 Installation of Approach cable

The existing cable trenches/cable raceways proposed to be used shall be identified in the survey report. The Contractor shall make its best effort to route the cable through the existing available cable trenches. Where suitable existing cable trenches are not available, suitable alternatives shall be provided after Employer approval. However, the approach cable shall be laid in the HDPE pipe in all condition.

Suitable provisions shall be made by the contractor to ensure adequate safety earthing and insulated protection for the approach cable.

All required fittings, supports, accessories, ducts, inner ducts, conduits, risers and any item not specially mentioned but required for laying and installation of approach cables shall be supplied and installed by the Contractor.

1.1.6 Optical Fibre Termination and Splicing

Optical fibre terminations shall be installed in Fibre Optical Distribution Panels (FODP) designed to provide protection for fibre splicing of preconnectorized pigtails and to accommodate connectorized termination and coupling of the fibre cables. The contractor shall provide rack/wall mounted fibre optic distribution panels (FODPs) sized as indicated in the appendices and shall terminate the fibre optic cabling up to the FODPs. The location of FODP rack shall be fixed by the Contractor, with the Employer's approval.

1.1.6.1 Fibre Optic Distribution Panel

At each location requiring the termination of at least one fibre within a cable, all fibres within that cable shall be connectorized and terminated in Fibre Optic Distribution Panels in a manner consistent with the following:

- a) All fibre optic terminations shall be housed using FODPs provisioned with splice organizers and splice trays. All fibres within a cable shall be fusion spliced to preconnectorized pigtails and fitted to the "Back – side" of the provided fibre optic couplings.
- b) FODPs shall be suitable for use with each of the cable types provided as part of this contract. FODPs shall accommodate pass-through splicing and fibre terminations.
- c) FODPs for indoor use shall be supplied in suitable cabinets/racks with locking arrangement.
- d) ALL FODPs shall be of corrosion resistant, robust construction and shall allow both top or bottom entry for access to the splice trays. Ground lugs shall be provided on all FODPs and the Contractor shall ensure that all FODPs are properly grounded. The FODP shall meet or exceed ingress protection class IP55 specifications.
- e) Flexible protection shall be provided to the patch cord bunches going out from FODP to other equipment.

1.1.6.2 Optical Fibre Connectors

Optical fibres shall be connectorised with FC-PC type connectors preferably. Alternatively connector with matching patch cord shall also be acceptable. Fibre optic couplings supplied with FODPs shall be appropriate for the fibre connectors to be supported. There shall be no adapters.

1.1.7 Service Loops

For purposes of this specification, cable and fibre service loops are defined as slack (extra) cable and fibre provided for facilitating the installation, maintenance and repair of the optical fibre cable plant.

- (a) Outdoor Cable Service Loops: In – line splice enclosures installed outdoors and mounted on the utility towers, shall be installed with sufficient fibre optic cable service loops such that the recommended minimum bend radius is maintained while allowing for installation or maintenance of the cable to be performed in a controlled environment at ground level.
- (b) Indoor Cable Service Loops: FODPs shall provide at least three (3) metres of cable service loop. Service loops shall be neatly secured and stored, coiled such that the minimum recommended bend radius' are maintained.
- (c) Fibre Units Service Loops: For all fibre optic cable splicing, the cable shall be stripped back a sufficient length such that the fan-out of fibre units shall provide for at least one (1) metre of fibre unit service loop between the stripped cable and the bare fibre fan-out.
- (d) Pigtail Service Loops: Connectorised pigtails spliced to bare fibres shall provide at least 1 metre of service loop installed in the FODP fibre organizer and at least one (1) metre of service loop to the couplings neatly stored behind the FODP coupling panels.
- (e) Fibre Service Loops: At least 0.5 metre of bare fibre service loop shall be provided on each side of all fibre splices. The bare fibre service loops shall be neatly and safely installed inside covered splice trays.

1.1.8 Methodology for Installation and Termination

All optical fibre cable termination, installation, stringing and handling plans, guides and procedures, and engineering analysis (e.g. tension, sag, vibration etc.) shall be submitted to the Employer for review and approval in the engineering/design phase of the project, prior to establishing the final cable lengths for manufacture. Installation procedures including details of personnel and time required shall be documented in detail and submitted to Employer for approval. All installation practices shall be field proven and ISO accredited.

All cable segments shall include service loops as specified in this specification. The maximum allowable stringing tension, maximum allowable torsional shear stress, crush strength and other physical parameters of the cable shall not be exceeded. The preventative measures to be taken shall be documented in details and submitted to Employer in advance of installation.

Optical fibre attenuation shall be measured after installation and before splicing. Any increase in attenuation or step discontinuity in attenuation shall not be acceptable and shall constitute a cable segment failure. In the event of cable damage or any fibre damage, the complete section (tension location to tension location) shall be replaced as mid-span joints are not acceptable.

Any or all additional steel work or modifications require to attach the fibre cabling to the overhead transmission/distribution line towers shall also be carried out by the contractor. It shall be the Contractors responsibility to provide adequate communications among all crew members and support staff to ensure safe and successful installations.

1.1.9 Cable Raceways

To the extent possible, existing cable raceways shall be utilized. The Contractor is required to provide and install any additional indoor cable raceways which maybe required for proper implementation of and communication system. This requirement shall be finalized during survey. The cable raceways shall conform to the following:

- (a) All cable raceways shall be sized to support full loading requirements plus at least a 200% safety loading factor
- (b) Indoor cable raceways shall be fabricated from construction grade aluminium, galvanized iron or anodized sheet metal or any other suitable material approved by the Employer. Suitable anticorrosion measures shall be provided. Steel fabricated raceways shall be finished inside and out, treated to resist rust and to form a metal-to-paint bond.
- (c) Mechanical construction drawings of the cable raceways shall be submitted for Employer's information & review.

ANNEXURE - III
GUARANTEED TECHNICAL PARTICULARS TO BE FILLED BY THE BIDDER

| Description | Tech.Particulars |
|--|------------------|
| Make & Model | |
| No. of Fibres in OPGW | |
| Mode | |
| Buffer type | |
| Buffer tube diameter | |
| Buffer tube material | |
| No. of buffer tubes | |
| No. of fibres per tube | |
| Identifiacton/numbering of individual tubes | |
| No. of empty tubes(if any) | |
| Filling material | |
| Strength members | |
| Binding yarn/tape | |
| 10%Aluminium clad steel wire(Daimeter & number) | |
| Aluminium alloy wires (Daimeter & number) | |
| Aluminium tube diameter | |
| Approximate outside diameter | |
| Cable diameter | |
| Cable cross section area | |
| Min. Breaking load /Ultimate Tensile Strength | |
| Fibre Strain margin | |
| Weight | |
| Crush strength | |
| Modulus of Elasticity | |
| Minimum bending radius | |
| Maximum bending radius | |
| Permissible CTS Tensile stress | |
| Coefficient of inner expansion | |
| Coefficient of expansion Cladding Core | |
| Nominal operating temperature range | |
| SC current transient peak temperature | |
| Maximum allowable temperature for lightning strike | |
| Available length of cable per drum: Min Max | |
| Splice loss(Max. & Min. allowable) | |

| | | |
|--|--|--|
| | Operating Temperature range - | |
| | Expected Cable Life | |
| | Fibre production method | |
| | Core diameter | |
| | Core non circularity | |
| | Cladding diameter | |
| | Core Clad Concentricity | |
| | Error | |
| | Cladding noncircularity | |
| | Protective coating type & material | |
| | Primary | |
| | Secondary | |
| | Coating concentricity | |
| | Colour coding scheme compliant with EIA395A/IEC3047 | |
| | Attenuation Coefficient @1310nm - | |
| | @1550nm - | |
| | Attenuation variation With Wavelength(+/-5nm Temperature- | |
| | Mode field non Circularity - | |
| | Chromatic Dispersion At 1310 nm At 1550 nm | |
| | Polarization mode dispersion coefficient | |
| | Temperature dependence: | |
| | Bend performance: | |

TECHNICAL SPECIFICATION FOR EPAX & ELECTRONIC PUSH BUTTON TELEPHONES :

1. Scope:

this specification covers design, manufacture, testing, packing, forwarding and delivery for destination of electronic private automatic exchanges and electronic push button telephones.

- 1.1. The Epax shall support a capacity of 128 universal ports, which can be programmed to the 4w & 2w E&M trunks (both conventional & PLCC version), 2w loop interrupt trunks and 2w subscribers. The Epax shall be supplied fully wired and equipped for all 128 universal ports as follows:

| | | |
|--------------------------------------|----------|--------------|
| E&M trunks (plcc version) | : | 16 |
| Subscriber lines | : | 16 |
| E1 CARDS | : | 2 NOS |

- 1.2 The E&M trunk requires 2 wires for signaling E & M and 4 wires for TX/RX speech. The subscriber line supports 2-wire loop signaling.
- 1.3 The EPAX should support both pulse and DTMF signaling and compatible with the existing switching equipment in the system.

1.4 The CPU card and PSU cards shall be duplicated for redundancy with hot switchover.

In the event of the failure of one or both of the cards, the stand-by card shall take over the functioning of the EPAX without any interruption.

1.5 The Epax should support 2 nos E1 channel cards- necessary interfacing cables and connectors shall be provided to interface e1 channel to broad band equipment.

- 1.6 the electronic push button telephones are intended to be connected to the Epax for providing speech on dialing network in the PLCC system provided on the 400 kv, 220 kv and 132 kv transmission lines.
- 1.7 The telephones shall support dialing on 2-wire loop mode.

2. Standards:

- 2.1. As there are no known standards, the EPAX and telephones proposed for purchase as per clause 7.1.0 shall conform to the relevant ccitt recommendation and itds tec specification including latest revisions, amendments / changes adopted and published as detailed below:

The epax and telephones shall however be tested thoroughly for the emc/emi compatibility as per the standards mentioned below:

| | |
|-----------|-------|
| Standards | title |
|-----------|-------|

| | |
|-----------------|--|
| Tec specn.g/pbx | Epax tec specification approved by dot |
|-----------------|--|

| | |
|---|---|
| -01/01/may'90. Tec specn g/tel- 01-02/june'96 Is 6873 series | <u>Electronic push button telephones</u> tec specification approved by dot |
| Iec 60255-21-1-1988 | methods of measurement of electromagnetic interference from various electrical disturbance vibration tests (sinusoidal) |
| Iec 255-21-2-1988 | shock and bump tests. |
| Iec 60255-22-1-1988 | 1 mhz burst disturbance test. |
| Iec 60255-22-2-1996 | electrostatic discharge tests |
| Iec 60255-22-3-2000 | radiated electromagentic field disturbance tests. |
| Iec 255-22-4-1992 | fast transient disturbance test |
| Iec 60870-(p1-p6). 1984-2000 | telecontrol equipment and system |
| En 55022 | radiated emission & conducted emission |
| Cispr | publication 22 (class a) |

2.2 Equipment meeting with the requirement of other authoritative standards, including is, which ensure equal or better performance than the standards mentioned above, shall also be considered. When the equipment offered by the bidder conforms to other standards, salient points of difference between standards adopted and the standards specified in this specification shall be clearly brought out in the relevant schedule. Four copies of such standards with authentic translation in English shall be furnished along with the offer.

3. Climatic conditions:

The Epax & push button telephones called in this specification are required to operate satisfactorily under climatic conditions given in the specifications.

4. Principal parameters

4.1 digital EPAX system:

| S. No. | Parameter | Description |
|--------|----------------------|--|
| 1 | Technology (type) | PCM / TDM with 32 bit microprocessor based digital technology electronic private automatic telephone exchange (Epax) on E & M signaling and DC loop signaling to work with PLC communication system. |
| 2 | Control | Stored Programme Control (SPC) |
| 3 | Back-up memory | Flash ROM based |
| 4 | System capacity | 128 universal ports programmable to e & m, loop interrupt trunks and subscribers. |
| | Required capacity of | E & m trunks : 16 |

| | | |
|----|----------------------------|---|
| | E & m trunks / subscribers | Subscriber lines : 16 E1 CARDS : 2 NOS |
| 5 | Configuration | Universal slots for extension / trunk interface |
| 6 | Priority facility | Shall be provided as per clause 4.9 |
| 7 | Communication links | 100 % non-blocking |
| 8 | Architectural design | Distributed design |
| 9 | System modularity | Easy expansion by adding modules |
| 10 | Approvals required | TEC WITH ISDN, BRI AND PRI |
| 11 | Trunk interface | 4W / 2W E & M interface with led indication with DP / DTMF E1 / r2 (2mbps digital link) with BNC connector VOIP interface Co trunk lines ISDN BRI & PRI trunk lines |
| 12 | Alarm on indication | Self-diagnostics with alarm on fault condition shall be provided. |
| 13 | Protection | All the trunk lines and subscriber lines shall be provided with surge arresters on the MDF |
| 14 | Extension interface | Station interface for normal analog PBT Digital extension interface for key phones Hybrid station interface for PBT / key phones |
| 15 | Redundancy | System should have redundancy for PSU & CPU. |
| 16 | System voltage | -48v dc (positive ground) + 15%, -10% with MCB protection |
| 17 | Power consumption | Less than 300w |
| 18 | Emi / emc | As per iec 17025: 2000 standard |
| 19 | Programming | Programming of the EPAX should be done using console/laptop that should be part of the exchange at no extra cost . |

.4.2 The microprocessor based EPAX should directly interface with communication transmission systems like power line carrier communication, optical fiber, satellite and microwave radio communication links. The subscribers must be able to communicate with local subscribers and far end subscribers through trunk lines. The EPAX should form a part of communication system and should be capable of switching speech paths on trunk routes.

The exchange should be compatible with the existing switching systems for its operation in conjunction with electronic four wire group selectors and EPAXS of any other make at far end stations. It would be the sole responsibility of the successful bidder to guarantee the compatibility of the EPAX with the existing switching systems.

4.3 The exchanges shall be manufactured to the state of art technology and employ the stored program technique by utilizing the principles of TDM/PCM. The system software shall be posted in flash memory as per the international standards. The equipment should be reliable and capable of giving service in adverse tropical temperature climatic condition. The equipment should work in non air-conditioned environment at EHT sub-

stations.

- 4.4 exchanges are to be self contained and provided with conventional facilities like dial tone, busy tone, ringing tone, ring back tone etc. The dialing pulse rate of subscriber for make and break ratio 1:2 (33.3msec. / 66.66msec.) And for trunk dialing 1:1 (50 m sec./ 50 m sec). The EPAX should be capable of working to single, two digit and three digit numbering schemes. The existing two digit numbering scheme as adopted in Aptransco network is however to be programmed in the EPAX initially.
- 4.5 main distribution frame shall be provided. Subscriber lines and junction lines are to be terminated on the MDF on one side of the terminal-block with the legend of the terminal connections clearly indicated in alphanumeric. The MDF shall be provided with individual surge protection.
- 4.6. Krone tag blocks are preferred to be used for the MDF. The supply of relevant wire terminating tool for the type of tag block quoted towards MDF is covered in the scope of this specification.
- 4.7. All the subscriber lines and the PLCC junction lines shall be provided with surge protection. Invariably suitable surge protectors in the form of gas discharge tubes and fuses are to be provided to protect electronic circuitry of the exchange from the damages due to external surges /spikes. Minimum maintenance and free workability on the equipment is to be ensured.
- 4.8. The EPAX should be provided with self-checking diagnostic facility to monitor the exchange continuously through software controlled program. The status of the call being established is to be visually displayed suitably as the call is progressing and faults by audible and visual indications. Reliability, security and quality of service must be the main features of the EPAX. The EPAX shall have the priority feature for a particular subscriber.
- The following state of art facilities are also to be provided.
- i. Priority cut-in into an engaged extension/tie line.
 - ii. Automatic cut off on forced release condition.
 - iii. Barred access to tie lines
 - iv. Call transfer
 - v. Call consult
 - vi. Call forward etc.
- 4.9. The priority cut in facility shall be provided in three hierarchies as stated below.
- i. Priority cut in into two busy local extensions.
 - ii. Priority cut in into one busy local extension and one local E&M tie trunk.
 - iii. Priority cut in into two busy E&M trunks in the same epax on transit call.
- Subscriber access to the E&M trunks shall be controlled through barred access facility.
- 4.10. **Specific trunk access:** if more than one route is available from the same

EPAX to an out station EPAX and in case the main route is busy, the selection of alternate route shall be made available on automatic selection of at least two alternative routes apart from the main trunk route. Specific trunk access shall also have to be provided. The subscriber shall be able to access a specific trunk route by dialing a special access code followed by the trunk route number.

The EPAX shall support exclusive load dispatch express type communication network with all to one and one to all type of trunk access. This feature shall be in addition to the normal all to all type.

- 4.11. The equipment should be housed in a standard steel cabinet with proper ventilation, and it should be dust and vermin proof housing. It should be painted as per relevant is and must have provision for access to the circuitry from both the front and rear sides. The ventilation fan shall work on 48v dc only.
- 4.12 The EPAXS shall be got wired for a minimum capacity of 128 universal ports. Required number of junction cards and line cards may be provided as per the schedule of materials.
- 4.13. Programming the required facilities on the EPAX with an ordinary telephone through the service line is preferred. For EPAXs, which cannot be programmed with an ordinary telephone, the bidder shall include the supply of the required programmer (example: EPROM programmer or console) within the scope of supply with a detailed write-up of the programming schedule through the operator console/ programmer.
- 4.14 the bidders are requested to quote as mandatory for one set of spare pcb modules as stated below:
 - i. Power supply unit
 - ii. Central processing unit
 - iii. Line interface card
 - iv. E&m trunk interface card
 - v. Switching matrix card

5. Electronic push button telephones:

The electronic push button telephones (desk top type) shall have the approval of telecom engineering centre of dot and suitable to work with plcc system.

- 5.1. A) type : electronic push button telephones (decadic) supporting both Pulse and dtmf signaling and ring led.
- b) dial speed : $10 \text{ pps} \pm 5\%$
- c) break make ratio : 2:1
- d) inter digit pause : 800 ms.
- F) reliability : the performance of the instrument should be very reliable and accurate with large mtbf as per tec requirements.

- 5.2 The telephones shall be provided with the following features:

- i. Decadic / DTMF dialing
 - ii. Last number redial
 - iii. Redial capacity up to 32 digits
 - iv. Ringer with volume control
 - v. Interchangeable transducers of electrodynamic type
- Electronic speech circuitry with regulated speech levels
Speaker phone

6.0. **Tests**

- 6.1. Type/acceptance and routine tests shall be carried out on the epax and electronic push button telephones proposed for purchase under this package in accordance with tec specification applicable as per clause 7.2.1.
- 6.2 EMI / EMC test

The epax is required to perform in a working environment of high voltage power system with high level of electromagnetic interference and calls for high degree of electromagnetic computability for achieving maximum throughout of traffic. The working environment is riddled with fast transients, currents, high voltage lightning & switching surges and severe short circuit current faults. The epax is therefore required to be tested thoroughly for its functional performance as per the EMI/EMC standards mentioned in clause no 7.2.1. Bids of bidders who do not enclose copy of authenticated certificate by a reputed laboratory either in India or abroad of testing the performance of the offered epaxs under severe electromagnetic interference conditions will be rejected.

7 **type tests:**

the following type tests shall be conducted on a selected sample of epax

- 7.1 epax
- i. Power supply test
 - ii. Protection test
 - iii. Engage pulse timing test
 - iv. Priority timing test
 - v. Digital pulse timing test
 - vi. Interdigit pulse timing test
 - vii. Releasing pulse timing test
 - viii. Test calls - subscriber to subscriber
 - subscriber to trunk
 - trunk to trunk

- 7.2 telephones
- i. Climatic test
 - ii. Vibration test
 - iii. Bump/fall/topple test
 - iv. Corrosion test
 - v. Protection test

8 **acceptance/routine tests**

- 8.1 EPAX
 - i. Power supply test
 - ii. Pulses timing test
 - iii. Test calls - subscriber to subscriber
 - subscriber to trunk
 - trunk to trunk
- 8.2. Telephones
 - i. Climatic test
 - ii. Vibration test
 - iii. Corrosion test
 - iv. Protection test

9 **Testing expenses**

- 9.1 the bidder shall furnish charges for conducting specified type tests as per price schedule.
- 9.2 in case of failure in any of the type tests, the supplier is required to modify the design of the material and the material shall be type tested successfully for the modified design.
- 9.3 bidders shall indicate the laboratories in which they propose to conduct the type tests. They shall ensure that the tests can be completed in these laboratories within the time schedule guaranteed by them in the appropriate schedule.
- 9.4 entire cost of testing for the acceptance and routine tests and tests during manufacture specified herein shall be treated as included in the quoted unit price of EPAX and electronic push button telephones.

10. Additional tests:

The purchaser reserves the right of having at his own expenses any other test(s) of reasonable nature carried out at bidder's premises, at site, or in any other place in addition to the aforesaid type, acceptance and routine tests, to satisfy himself that the material comply with the specifications.

Test reports:

- a. i. Copies of the type tests shall be enclosed with the bid
- ii. Before dispatch of the equipment at least six (6) copies along with one original shall be submitted. One copy shall be returned duly certified by the purchaser only after which the material will be dispatched.
- b. Record of routine test reports shall be maintained by the bidder at his works for periodic inspection or as and when desired by the purchaser's representative.
- C. Test certificates of tests conducted during manufacture shall be maintained by the bidder. These shall be produced for verification as and when desired by the purchaser.

Annexure I
Guaranteed technical particulars for EPAX
(to be filled by the bidder)

| S. No. | Parameters | Description |
|-----------|--|-------------|
| 1 | Technology (type) | |
| 2 | Control | |
| 3 | Back-up memory | |
| 4 | System capacity 1. Full capacity of trunks 2. Initially required capacity Required capacity of E & m trunks / subscribers | |
| 5 | Configuration | |
| 6 | Priority facility | |
| 7 | Communication links | |
| 8 | Architectural design | |
| 9 | System modularity | |
| 10 | Approvals required | |
| 11 | Trunk interface with led indication for all trunks | |
| 12 | E1 interface | |
| 13 | Alarm on indication | |
| 14 | Protection | |
| 15 | Extension interface | |
| 16 | Redundancy | |
| 17 | System voltage | |
| 18 | Power consumption | |
| 19 | Emi / EMC | |
| 20 | The EPAX shall be compatible to the following codes for pulses in various signaling circuits. (i) engage pulse (ii) priority pulse (iii) digit pulse (iv) inter digit pulse (v) release pulse | |

Date :

Place :

Signature of manufacturer / supplier
Name & address

signature of the bidder

name:

Whether authorised attorney of the
tendering company

Name of the tendering company with
seal

Annexure II

Guaranteed technical particulars for push button telephones (to be filled by the bidder)

| Item no. | Description | Data |
|-----------------|---|-------------|
| (a) | Manufacturer's name & address / supplier's name & address | |
| (b) | Governing standards | |
| (c) | Type | |
| (d) | Dial speed | |
| (e) | Break-make ratio (pps with +/-) | |
| (f) | Inter digit pause (msec.) | |
| (g) | Reliability | |
| (h) | Ringing voltage (v dc) | |
| (i) | Hook-switch endurance (no. Of operations) | |
| (j) | Operating temperature (deg. C) | |
| (k) | Tone/pulse switchable | |
| (l) | Last no. Redial facility | |
| (m) | Ringer off-low-hi facility | |
| (n) | Hold on music | |
| (o) | Pause facility | |
| (p) | Ring led (yes/no) | |
| (q) | Display | |

Date :

Place :

Signature of manufacturer/supplier
Name & address

signature of the bidder
name :

Whether authorised attorney of the tendering company

Name of the tendering company with seal

SECTION – 1 : GENERAL

TECHNICAL SPECIFICATION FOR FIBRE OPTIC TESTING INSTRUMENTS

1.1

The intent of this specification is to provide functional and performance requirements for the fibre optic communication system to be procured in this packages. It covers design ,manufacturing, supply , ,testing before despatch with accurate calibration of fibre optic testing instruments like OTDR, fusion splicing machines, optical power meter,optical power source, tools for cutting, splicing of OPGW type fibre optic cable and optical fibre approach cable with necessary accessories like patch cards, test probes with suitable end connectors and binoculars for monitoring of OFC links and its hardware fittings. The testing instruments shall work satisfactorily in the EHT substations where high EMI/EMC environment presents and to splice the OPGW cable which is laid on the 132/220/400kv EHT lines in APTRANSCO.

2.1

it is not intent to specify completely herein all the details of the design, and construction of optical testing instruments covered under this specificaiton. However equipment shall confirm in all respects to high standards of engineering, design and workman ship and shall be capable of performing in continuous commercial operation upto the bidder's guarantee, in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have final authority to accept any equipment. Not withstanding to any thing contained above, the offered equipment shall be complete with all components necessary for their effective and trouble free operation.such, components shall be deemed to be within the scope of bidder's supply irrespective of whether those are specifically brought out in this specification and / or the commercial order or not. The bidder shall not be eligible for extra charges for such material. Further the minimum principal parameters mentioned in the technical specification should be fulfilled.

2.2. **Guarantee:**

The Instruments shall be guaranteed for trouble free operation for twelve (12) months from the supply date. In case of failure within this period, the contractor shall replace the faulty Instruments at no extra costs to the purchaser.

2.5

Operational Life

The fibre optic testing instruments shall be designed for an operating life of not less than 15 years with recommended servicing and replacement of parts. Such recommended services and replacement of parts shall be brought out in the bid. The contractor shall provide technical support and spare parts for a minimum period of 5 years from the date of final acceptance.the contractor shall demonstrate a specified level of functionality of the equipment during tests in the factory. After the equipment is supplied, the contractor shall demonstrate all of the functions and availability characteristics during well- structured field tests.

2.6 **Bidders Qualifying Requirement.**

- 2.6.1 Bidders shall also refer to qualifying requirements given in section v.
- 2.6.2 The fibre optic testing instruments supplied should be suitable for working in a hostile environment with electrostatic discharges. Emi/emc compensation shall therefore be provided in order to meet electro-magnetic compatibility (emc) requirement.
- 2.6.3 ISO 9000 / is14000 certified manufacturers would be preferred.

3.0 Test requirements:

Routine tests shall be carried out on the testing instruments to show the guaranteed performance figures are achieved and that the equipment meets the requirement of this specification. The general particulars, and guarantees stated in guaranteed technical particulars and the relevant Indian standard shall be complied with.

3.1 testing and inspection:

The contractor shall carry out the tests stated in accordance with the conditions of this specification. Any additional tests as in the opinion of the purchaser necessary to determine specification requirements shall be carried out either at manufacturer's work site or elsewhere in ordinary working conditions without any extra charge. Type tests may be omitted at the discretion of the purchaser if satisfactory evidence is given of such tests already made on identical equipment.

All materials used shall withstand satisfactorily such routine tests as are customary in the manufacture of the types of equipment included in the contract works.

Factory acceptance tests shall be carried out to the satisfaction of the purchaser and in his presence at such reasonable times as he may require. Not less than three weeks notice of all tests shall be given to the purchaser in order that he may be represented. As many tests as possible shall be arranged together. Six copies of the contractor's record of tests shall be supplied to the purchaser.

Measuring instruments shall be approved by the purchaser and if required, shall be calibrated at the expense of the contractor at an approved laboratory.

All apparatus, instruments and connections required for the above tests shall be provided by the contractor but the purchaser will permit the contractor to use for the tests at site any instruments and apparatus which may be provided permanently at site by the purchaser subject to the operation of the system and carrying out of other contracts and with condition upon the contractor accepting liability for any damage which may be sustained by the purchaser's equipment during the test.

The purchaser will also provide free of charge on site electrical energy, if available, for the purpose of approved preliminary tests and for the final tests. If further preliminary tests are necessary or if further final tests are required due to the contract works not complying with the conditions of this specification, the purchaser may call upon the contractor to pay the costs of providing the additional electrical energy required.

The contractor shall invariably furnish a detailed document on the type tests, routine tests and factory acceptance tests including the test procedures atleast 6 weeks prior to the programmed date of factory testing & inspection by purchaser's representative at the contractor's works and got the same approved by the purchaser who shall not take more than 2 weeks from the date of receipt of the test procedure document for its approval the date for factory testing of the cable, equipment by the purchaser's representative at contractor's works shall be communicated by the contractor immediately after approval. If required by the purchaser, test specimens shall be prepared for check testing and forwarded at the expense of the contractor to an independent testing authority selected by the purchaser. The cost of all such tests and/or analysis shall be borne by the contractor.

Waiving of inspection or performing of inspection by the purchaser of work, equipment or material, whether carried out or supplied by the contractor or subcontractor, shall not relieve the contractor from his liability to complete the contract works in accordance with the contract or exonerate/ relieve him from any of his guarantees.

5.0 QUALITY ASSURANCE PROCEDURES

4.1. GENERAL

The bidder shall operate a quality management system which is in conformity with the requirement of iso:9001. The bidder will be responsible for the qulty assurance of all goods and services through all phases of the contract from initial furnishing to final acceptance. This constitutes the assurance that all such goods and services are in conformity to the required quality in terms of technical specification, delivery, commissioning and price requirement as defined in the contract.

4.2 QUALITY ASSURANCE SYSTEM AND REQUIREMENTS

The bidder's quality assurance system shall meet the following criteria:

- a) It will be formally accredited by an outside party as to compliance with the requirements of iso:9001. Copies of all assessment and visit reports related to this accreditation shall be available to the purchaser throughout the duration of the contract.
- b) It shall be documented and presented in the form of the company quality manual, the associated quality system procedures at each bidder location involved in the project, and a quality plan specific to the contract.
- c) The first formal issue of the contract specific quality plan shall be agreed between the purchaser and the bidder prior to contract signing. This quality plan shall then form part of the contractual documentation and shall not be changed without prior agreement with the purchaser.

4.3 ADDITIONAL QUALITY ASSURANCE REQUIREMENTS

- A) the purchaser shall have access to the supplier's premises at any mutually agreed time and be provided access to inspect and assess the quality system should any specific need arises. The purchaser shall also be able to

conduct on site reviews to discuss status, issues, progress etc., as deemed mutually appropriate. The bidder shall make available all the facilities during any visit to the works of manufacturer/ sub vendor.

The entire costs of the visits of the purchaser's representatives to the supplier's premises shall be borne by the purchaser.

b) the purchaser shall have access to all relevant documentation including qualification and manufacturing test specifications and any other contract specific technical documentation including qualification test specifications for verification that the quality procedures are in accordance with the contract-specific quality plan.

When the supplier is satisfied that the goods and services are ready for release in accordance with documented procedures, the approval of the purchaser for release shall be sought.

When the purchaser is satisfied that the goods and services are ready for release, he will issue necessary written authorisation. This authorisation will not absolve the supplier from his responsibility for meeting the requirements of the contract, nor shall modify the commencement date of the warranty period.

5.0 performance guarantee

The testing instruments shall be capable of continuous commercial operation for a minimum anticipated life span of fifteen years. The bidder shall also furnish the details of desired services and replacement of parts and its periodicity along with the bid.

The system shall be guaranteed for trouble free operation for a minimum period of twelve (12) months from the final date of commissioning whichever is earlier.

6.0 DOCUMENTATION

All drawings shall conform to international standards organisation (ISO) 'a' series of drawing sheet. All dimensions and data shall be in system international units. Wherever possible, the documentation should use standard symbols and vocabulary recommended by the international telecommunication union (ITU), and the international electro technical commission (IEC).

7.0 LIST OF DRAWINGS AND DOCUMENTS

The bidder shall furnish full description and illustration of the materials offered.

The bidder shall furnish the drawings, calculations, test reports and literature pertaining to specified items (6 copies) which shall include but not be limited to the following information:

- a) name and location of the factory or company manufacturing the fibre optic testing instruments.
- b) technical standards, manufacturing technology and quality assurance system for the fibre optic testing instruments
- C) detailed description of the fibre optic testing instruments including block diagrams, section view, circuit diagrams and dimensions of overall equipment.

- D) Technical Standards of all other main elements used in the equipment offered.
- E) Technical measures for ensuring the life time of 15 years with recommended servicing and replacement of parts.
- F) Schematic diagrams.
- G) Mounting drawings.
- H) Test reports /calibration reports and certificates showing compliance with all required tests.
- I) Specific instructions for utilization of the testing instruments.
- j) Description of quality control/assurance programme.
- k) Details of packing.

The supplier shall within 4 weeks of placement of order, submit three sets of final versions of all the above said drawings for purchaser's approval. The purchaser shall communicate his comments/approval on the drawings to the supplier within two/three weeks. The supplier shall, if necessary, modify the drawings and resubmit three copies of the modified drawings for purchaser's approval within two weeks from the date of purchaser's comments. After receipt of purchaser's approval, the supplier shall within three weeks, submit 10 prints, one set of good quality reproducibles, one set of micro films of the approved drawings for purchaser's use.

Three (3) copies of acceptance and routine test certificates, duly approved by the purchaser, shall accompany the despatched consignment.

The manufacturing of the equipments shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the purchaser. All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at the supplier's risk.

6 sets of nicely printed and bound volumes of operation, maintenance in English language for each instrument shall be submitted by the supplier for distribution, prior to the despatch of the fibre optic testing instruments.

The manual shall contain all the drawings and information required for testing,, trouble shooting, operation and maintenance of the fibre optic cable and equipments. The manual shall also contain a set of all the approved drawings, type test reports and calibration reports etc.

8.0 Transportation

The supplier shall be responsible for transportation of all the fibre optic testing instruments to The. purchaser's site/stores including overseas and inland transportation, as well as for loading and unloading of the fibre optic cables and equipment.

The supplier shall make a careful examination of access rail-roadways to each of the site(s)/stores in order to confirm the practical maximum transport weight and dimensions, as well as a careful examination of the ports of disembarkation, in order to confirm the capacity of the hoist cranes installed there and the capacity of the access roads to those ports.

The supplier shall be responsible for the full cost of any repairs or restorations required due to transit, damage or otherwise altered due to the transportation of fibre optic testing instruments in his supply, including the replacement of any posts, signs,

pollards, etc., which have been damaged or moved and of any overhead wires or structures moved or brought down.

9.0 Insurance

The supplier shall insure all shipments and works at his own expenses for not less than the full replacement cost plus any additional cost for accelerated manufacture of the replacement parts. Loss of or damage to testing instruments during shipping or transportation to the site/stores or other wise shall not constitute grounds for claims for extension in time or for extra payment.

10.0 schedules required to be submitted:

The tenderes shall fill in the following annexures & schedules which form part of the tender specification and offer. If the schedules are not submitted duly filled in with the offer, the offer shall be liable for rejection.

Bidders are requested to refer to schedules.

Statement giving prices : for all recommended spares for ten years of satisfactory operation of each equipment.

Unless otherwise brought out separately by the bidder in the schedules of deviations the offers shall be deemed to confirm to the specification scrupulously. All deviations from the specification shall be brought out in the schedule of deviation. The discrepancies between the specification and the catalogues or literature submitted as part of the offer shall not be considered as valid deviations unless specifically brought out in the schedule of deviations.

For any deviation from the specification, which is not specifically brought out in the schedule of deviation, the offer may be liable for rejection. the deviations brought out in the schedule shall be supported by authentic documents, standards and clarifications. otherwise the offer may be liable for rejection.

11.0 Information to be filled invariably by the tenderer

For ready reference of the tenderer, the items of information required to be invariably furnished by the bidder in his offer are listed below:

- i) four copies of the authentic English translation of each of the standards to which the offered equipment conforms in case those are other than the standards specified in this specification.
- ii) all annexures and schedules
- iii) drawing listed in clause no.7.0.

12.0 training of purchaser staff.

The supplier shall be required to provide training at no extra cost to APTRANSCO engineers at the site. An important objective of training is to increase the ability to control, supervise and carry out maintenance work on plant and equipment supplied by the contractor.

The supplier shall be required to provide facilities for imparting training at no extra cost to (2) two engineers to be nominated by the purchaser (APTRANSCO) for the complete package of OLTE testing equipment at the fields sites for (2) two days. An important objective of training is to increase the ability to familiarize, carry out testing and maintenance work on equipment supplied by the contractor. The supplier shall provide boarding, lodging and transportation to the training place as a part of the contract without any additional financial commitment to APTRANSCO.

The training shall cover, at least the following:

- i) detailed theoretical and practical training on fibre optic testing instruments.
- ii) operation & maintenance and repairs technique required for efficient upkeep of fibre optic testing instruments.
- iii) test & measurement procedures.
- iv) fibre-optic accessories, viz. Patch-cord, fibre-optic connectors, pigtails etc. The contractor shall ensure that the training course fully, encompass all aspects of the basic utilization and calibration of the testing instruments.

14.0 Training Instructors.

The training instructors provided by the contractor shall be fully qualified and experienced engineers, who have had experience and good knowledge of the english Language. They will have had experience of training engineers on similar topics and will be fully familiar with the plant or equipment to be supplied or installed.

13.1 Training Programme.

The contractor shall develop and plan detailed training programmes using training methods most appropriate to the subject matter and the level of trainees. These training programmes shall be submitted to the purchaser for his approval. The programme of training shall be discussed and finalised with the purchaser.

14.0 Reliability.

The requirements of communication channels for remote control are very high concerning reliability and security.

Reliability of the equipments offered shall be better than 99.99% per year availability for overall end equipment.

15.0 compatibility with other equipments.

The vendor shall be responsible for the integrated system working i.e. He shall ensure the compatibility and work ability of the system/sub-system offered by him with fibre optic cable ,fibre optic communiaction equipmnet for testing and o&m of the system.

Section - II

TECHNICAL SPECIFICATIONS FOR FIBRE OPTIC TESTING INSTRUMENTS

- 1.0 Design ,Manufacture, Factory testing before despatch, packing, supply, testing of OTDR, Splicing Machine, Optical Power Meter and other tools and accessories as specified in the specification for testing of Fibre optic equipment at 1310 nm & 1550 nm and splicing of OPGW & OFAC cables with required tools and accessories.
- 1.1 TRAINING OF PURCHASER'S ENGINEERS AT SITE.
- 1.2 Arrangement for Shipment, safe delivery on F.O.B. port of shipment and C.I.F. Indian Port for equipment of Non-Indian Origin. Safe onward inland transport and delivery of equipment at the purchaser's designated store/destination for equipments of both Indian and Non-Indian origin.
- 1.3 The Equipment supplied after testing guaranteeing its performance for a period of 12 months from the date of final testing acceptance by APTRANSCO. It is not the intent of this specification to specify completely herein all details of the design and construction of the equipment or materials to be supplied or services to be rendered. However, the equipment shall conform in all respects to high standards of Engineering, Design and workmanship and shall be capable of performing in continuous operation as per latest international standards, in hostile electrical environments prevailing near Extra High Voltage grid substations, in absence of any air-conditioning environment. The purchaser will interpret the meanings of drawing, documents and specification and shall have the power to reject any work or material which in his judgement is not in accordance therewith.
- 1.5 the equipment shall be in line with current practice as followed by dept. Of telecommunication (Govt.of India) or by internationally accepted practices for communication system.
- 1.6 whether called for specifically or not, all accessories required for normal and satisfactory operation (as deemed fit by the purchaser) shall be considered to be a part of the tenderer's basic scope of supply and no claim for extra payment will be accepted on these grounds.
- 2.0 the bidder shall furnish detailed instructions and precautions to be taken during handling at the port of entry, local transportation and handling at stores including long storage at purchaser's stores. This will in no way relieve the contractor from the overall responsibility of supplying the materials up to purchaser's designated destination store/ site.

Standards:

The goods supplied under this contract shall conform to the latest relevant itu-t standard and/or other standards prescribed in the technical specifications.

3.2 EMC standards

Equipment offered under the scope of work shall, in general, be suitable for working in environment prevalent in and around extra high voltage switch yards. The equipment shall meet very high standards of electromagnetic compatibility. The following standards as amended up to date may serve as guidelines.

- i) en 55022 radiated emission
- ii) en 55022 conducted emission
- iii) iec 801-3 radiated susceptibility
- iv) iec 801-4 conducted susceptibility
- v) iec 801-2 electrical discharge.
- vi) iec 255-4 high frequency disturbance (damped voltage & current surges)
- vii) iec 870-2 voltage & current surges
- viii) iec 801-5 - do -
- X) Cispr pub.22 (class-a)

The bidder shall enclose proof of the offered equipments performance within the limits specified in the above standards and/ or any other international standards including jis etc. A copy of the each of the other standard in english version shall be enclosed with the bid.

4.0 General Technical Requirements Of Olte & Hardware

- 4.1.1 the equipment shall be modular in design, compact and composite construction including power supply, switching and control units.
- 4.1.2 the equipment shall be fully solid state, field proven and adopt state-of-art technology.
- 4.1.3 the mechanical design and construction of each unit sub-assembly shall be inherently robust and rigid under all conditions of operation, adjustment, replacement, storage and transport.
- 4.1.4 the equipment shall have self cooling arrangement. No forced cooling using fans etc. Is envisaged.
- 4.1.5 The equipment shall be operative from a nominal 230v ac power supply with voltage varying 230 +/- 20%.
- 4.1.6 all important switches/controls on front panel shall be provided with suitable safeguards such as interlock system to avoid accidental operation by the maintenance personnel.
- 4.1.7 the equipment shall be made vermin proof, protected against dust and insects. The indoor equipment shall conform to ip 52 and outdoor equipment to is-2147.
- 4.1.8 the equipment shall be able to work in saline atmosphere in coastal areas and should be protected against corrosion.

- 4.1.9 all components shall be easily accessible for testing. Similarly all bays and bay-panel wiring shall be easily accessible.
- 4.1.11 special tools required for wiring are included within the scope of the specifications and shall be provided alongwith the equipment.

4.1.12 Life Time Spares.

The purchaser would like to stock life time spares as and when the supplier decides to close down the production of offered equipment. In such an event, the supplier shall give atleast one year notice to the purchaser alongwith the list of recommended life time spares.

4.2.0 The supplier shall provide the following document.

- 4.2.1 operational manuals : one copy with each equipment and 2 copies prior to inspection.
- 4.2.2 installation manuals : one copy with each equipment and 2 copies prior to inspection.

The documents shall provide details for

- 4) Technical description
- 5) Configuration procedure
- 6) Power consumption

4.4 Operational requirement.

- 4.3.1 each sub-assembly shall be clearly marked to show its function, schematic reference so that they are identifiable from the component layout diagram in the handbook.
- 4.3.2 maintenance philosophy is to replace faulty units after quick analysis of monitoring and alarm indications and built-in test equipment. The actual repair will be undertaken at suitable centralised repair centre. The installation at site shall involve simply plug - in connection only.
- 4.3.3 each station shall be provided with alarm interface card to take upto 4 external alarms (say air conditioned failure etc.)

5.0 COMPATIBILITY OF EQUIPMENT

Testing instruments are such that it will be best compatible with existing system(s) viz., foc, olte for testing and maintenance of the system.

SDH ANALYZER.

The equipment shall be suitable for used during installation , commissioning and maintenance of pdh, sdh and equipment. The equipment should support stm-1(155 mbps) and e1 lines electrical and optical interfaces.

Technical specification

1. **Optical interfaces** : STM-1
2. **Wavelength ranges (nm)** : 1310, 1550
3. **Connector** : FC/PC
4. **Electrical interfaces** : shall provide the following electrical interfaces
STM-1 (bnc), 140 mbps e4 (bnc), 45 mbps ds3 (bnc), 34 mbps e3 (bnc), 2 mbps e1 unbalanced 75 ohm (bnc), 2 mbps e1 balanced 120 ohm (rj48), 2 mbps E1 balanced high -z (RJ48) on rx, 1.544 mbps ds-1 balanced 00 ohm (bantam), ECL NRZ input monitor for 155, 622 mbps
5. **Clocking** : internal, loop-timed, external (mts/sets), 2 mhz, inter- module
6. **SDH mappings** : **c12 mapping (2 mbits in stm-1, au-4 Asynchronous mode), c3 mapping (34 mbits in stm -1, au-4), c3 mapping (45 mbits in stm-1, au-4) c4 mapping (140 mbits in stm-1)**
7. **Nx64 kbps channel testing** : shall be capable of generating and measuring Signals in the 64 kbps or nx64kbps channels carried within an e1 frame.
8. **Test patterns** : **test patterns may be generated and measured for any of the provided bit rates.**
The following test patterns must be available.
Prbs : $2^{15}-1$, $2^{20}-1$, $2^{23}-1$, $2^{31}-1$, $2^{15}-1$ inv., $2^{20}-1$ inv., $2^{20}-1$ inv.,
 $2^{23}-1$ inv., $2^{31}-1$ inv.
9. **Clock frequency offset** : plus or minus 100 ppm in 0.1 ppm steps on Electrical and optical interfaces
10. **Power requirements** : should be capable of being powered from its

| | | |
|---|---|---|
| | | own Internal batteries or ac line supply. Operation from batteries shall be possible for at least 3 hours. |
| 11. Weight : | : | less weight |
| 12. Display | : | colour display with high resolution. |
| 13. Storage capability | : | should be capable of storing results and setup data |
| 14. Serial interface | : | rs-232 or rs-232/c |
| 15. Ethernet interface | : | 10 base t (rj45) for connection to pcs via ethernet Lan. |
| 16. Synchronization with an external signal (clock) | : | should be able to generate signals synchronized an external clock as the timing ref. |
| 17. External reference signal | : | sinusoidal 2048 khz or 2048 kbps data signal. |

Instrument shall support the following features also.

- Auto configuration
- Generation and analysis of soh and poh
- Byte capturing
- Tandem connection monitoring
- Error insertion / detection
- Alarm insertion / detection (system shall be able to detect and record the following alarm types los, lof, au-lof, ms-ais, ms-rdi, rs-tim, au-ais, au-lop, au-ndf, hp-rdi, hp-uneq, hp-tim, hp-plm, tu-ais, tu-lop, tu-lom, lp-rdi, lp-plm, lp-uneq, lp-tim, lss, lp-rfi)
- Round trip delay: measurement of round trip delay of signals sent through networks. The measurement shall be possible with sdh and pdh signals.
- Automatic protection switching measurement
- Pointer analysis: shall display the current value of the au and tu pointers.
- Pointer generation: shall be able to generate au and tu pointer.
- Vc-12 tributary scanning & monitoring
- S/w and h/w upgrades: it shall be possible for the unit to be upgraded with new s/w features without the unit being returned to the vendor. It shall be possible to upgrade to stm-4, stm-16 etc..

Operation of the unit shall be via a graphical user interface. Use of menus, function keys, graphic displays to simplify operation is preferred. It shall be possible to operate the unit whilst desk or floor mounted, or whilst handheld.

ANNEXURE
GTP PARTICULARS FOR SDH ANALYSER

| S.no. | Description |
|-------|--|
| 1. | Name & address of the manufacturer |
| 2. | Optical interfaces : |
| 3. | Wavelength ranges (nm) : |
| 4. | Connector : |
| 5. | Electrical interfaces : |
| 6. | Clocking |
| 7. | Sdh mappings : |
| 8. | Nx64 kbps channel testing : (whether possible or not y/n) |
| 9. | Test patterns : |
| 10. | Clock frequency offset : |
| 11. | Power requirements : |
| 12. | Weight : |
| 13. | Display : |
| 14. | Storage capability : |
| 15. | Serial interface : |
| 16. | Ethernet interface : |
| 17. | Synchronization with an external : signal (clock) |
| 18. | External reference signal : |
| 19. | Whether all specified features supported (y/n) : |

**Signature of the bidder
with official seal**

SDH ANALYZER. STM-4/16

The equipment shall be suitable for used during installation , commissioning and maintenance of PDH, SDH and equipment. The equipment should support stm-4(620 mbps) and e1 lines electrical and optical interfaces.

Technical specification

1. Optical interfaces : STM-4/16
2. Wavelength ranges (nm) : 1310, 1550
3. Connector : FC/PC
4. Electrical interfaces : shall provide the following electrical interfaces
Stm-4 (bnc), 140 mbps e4 (bnc), 45 mbps ds3 (bnc), 34 mbps e3 (bnc), 2 mbps e1 unbalanced 75 ohm (bnc), 2 mbps e1 balanced 120 ohm (rj48), 2 mbps e1 balanced high –z (rj48) on rx, 1.544 mbps ds-1 balanced 00 ohm (bantam), ecl nrz input monitor for 622 mbps

- 5. Clocking** internal, loop-timed, external (mts/sets), 2 mhz, inter- module
- 6. Sdh mappings :** **c12 mapping (2 mbits in stm-4, au-4 Asynchronous mode), c3 mapping (34 mbits in stm-4, au-4), c3 mapping (45 mbits in stm-4, au-4) c4 mapping (140 mbits in stm-4)**
- 7. Nx64 kbps channel testing :** shall be capable of generating and measuring Signals in the 64 kbps or nx64kbps channels carried within an e1 frame.
- 9. Test patterns :** test patterns may be generated and measured for Any of the provided bit rates.

The following test patterns must be available.

Prbs : $2^{15}-1$, $2^{20}-1$, $2^{23}-1$, $2^{31}-1$, $2^{15}-1$ inv., $2^{20}-1$ inv., $2^{20}-1$ inv.,
 $2^{23}-1$ inv., $2^{31}-1$ inv.

Programmable word: 16 bits

The receiver must be able to be set to ignore the test pattern for monitoring live systems.

- 9. Clock frequency offset :** plus or minus 100 ppm in 0.1 ppm steps on Electrical and optical interfaces
- 10. Power requirements :** should be capable of being powered from its Own Internal batteries or ac line supply. Operation from batteries shall be possible for at least 3 hours.
- 11. Weight :** less weight

| | | |
|---|---|--|
| 12. Display | : | colour display with high resolution. |
| 13. Storage capability | : | should be capable of storing results and setup data |
| 14. Serial interface | : | rs-232 or rs-232/c |
| 15. Ethernet interface | : | 10 base t (rj45) for connection to pcs via ethernet Lan. |
| 16. Synchronization with an external signal (clock) | : | should be able to generate signals synchronized an external clock as the timing ref. |
| 17. External reference signal | : | sinusoidal 2048 khz or 2048 kbps data signal. |

Instrument shall support the following features also.

- Auto configuration
- Generation and analysis of SOH and POH
- Byte capturing
- Tandem connection monitoring
- Error insertion / detection
- Alarm insertion / detection (system shall be able to detect and record the following alarm types los, lof, au-lof, ms-ais, ms-rdi, rs-tim, au-ais, au-lop, au-ndf, hp-rdi, hp-uneq, hp-tim, hp-plm, tu-ais, tu-lop, tu-lom, lp-rdi, lp-plm, lp-uneq, lp-tim, lss, lp-rfi)
- Round trip delay: measurement of round trip delay of signals sent through networks. The measurement shall be possible with sdh and pdh signals.
- Automatic protection switching measurement
- Pointer analysis: shall display the current value of the au and tu pointers.
- Pointer generation: shall be able to generate au and tu pointer.
- Vc-12 tributary scanning & monitoring
- S/w and h/w upgrades: it shall be possible for the unit to be upgraded with new s/w features without the unit being returned to the vendor. It shall be possible to upgrade to stm-16 etc..

Operation of the unit shall be via a graphical user interface. Use of menus, function keys, graphic displays to simplify operation is preferred. It shall be possible to operate the unit whilst desk or floor mounted, or whilst handheld.

Annexure
GTP PARTICULARS FOR SDH ANALYSER

| S.no. | Description |
|-------|--|
| 1. | Name & address of the manufacturer |
| 2. | Optical interfaces : |
| 3. | Wavelength ranges (nm) : |
| 4. | Connector : |
| 5. | Electrical interfaces : |
| 6. | Clocking |
| 7. | Sdh mappings : |
| 8. | Nx64 kbps channel testing : (whether possible or not y/n) |
| 9. | Test patterns : |
| 10. | Clock frequency offset : |
| 11. | Power requirements : |
| 12. | Weight : |
| 13. | Display : |
| 14. | Storage capability : |
| 15. | Serial interface : |
| 16. | Ethernet interface : |
| 17. | Synchronization with an external : signal (clock) |
| 18. | External reference signal : |

Signature of the Bidder

Technical specification for fusion splicing machine:

Fusion splicer shall be of state of the art single mode and multimode which can complete a splice sequence together with a detailed loss estimation in less than 15 seconds. Fusion splicer shall have the following features:

1. Core-to core fiber alignment using profile alignment system technology
 2. Environmental resistance features
 3. Most compact and lightest
 4. Arc calibration-free system
 5. 4.1" tft color lcd monitor
 6. Dual directional operation system
 7. Long life battery
 8. Fibre holder option
 9. Software upgrade via internet
 10. Detachable work table

Specification :

- | | | | |
|--------|--|--|---|
| I. | Applicable fiber | : | sm / mm/ds and other single mode fibres |
| II. | Fiber count | : | single |
| III. | Fiber cleaved length standard | : | 16 mm |
| | Fiber holder | : | fh-60-250 and fh-60-900 (10mm cleave) |
| IV. | Average fusion loss | : | 0.01 d b (sm), 0.01 d b (mm), 0.04 d b (ds) |
| V. | Storage of splice result working mode | : | 2000 or more splice results auto & manual |
| VI. | Splicing time | : | < 15 sec. |
| VII. | Return loss | : | > 60 d b |
| VIII. | No. Of splice modes | : | 100 modes. |
| IX. | Splice loss estimating function | : | should be available. |
| | attenuation splicing function | : | auto attenuation mode :0.1 d b to 15 d b (0.1 db Step) |
| X. | Tension test | : | 1.96 to 2.25n |
| XI. | Fiber magnification | : | 132 (x/y simultaneous view) or 264 (high Magnification view) |
| XII. | Operational environmental condition: | 0 to 5000 m above sea level, 0 to 95% rh And 10 to 50°C and upto 15m/s wind velocity. | |
| XIII. | Storage condition | : | 0 to 95% rh and -40 to 80°C respectively |
| XIV. | Tube heater | : | built-in tube heater with 30 programmable heating Modes. |
| XV. | Applicable protection sleeve length: | 60 mm, 40 mm and micro sleeves | |
| XVI. | No.of splice cycles with battery: | typical 160 cycles | |
| XVII. | Electrode life | : | 2500 arc discharges. |
| XVIII. | Viewing method and display | : | two cmos cameras and 4.1" tft color Lcd monitor |
| XIX. | Power supply | : | 100 to 240 v ac, with battery pack; shall operate on Battery at least for 4 hours. |

Standard accessories (these accessories should be supplied in fsm package)

1. Ac adapter / battery charger
2. Ac power cord
3. Dc power cord
4. Spare electrodes
5. Usb cable
6. User manual
7. Battery pack
8. Battery charge cord
- 9. High precision fibre cleaver**
10. J plate
11. Carrying case

Annexure
Gtp for fusion splicing machine

| S.no. | Description |
|-------|-----------------------------------|
| 1. | Make & model : |
| 2. | Fibre count |
| 3. | Applicable fibres |
| 4. | Average fusion loss |
| 5. | Storage of splice result |
| 6. | Working mode |
| 7. | Splicing time |
| 8. | Return loss |
| 9. | No. Of splice modes |
| 10. | Splice loss estimating function |
| 11. | Attenuation splicing function |
| 12. | Fibre magnification |
| 13. | Tension test |
| 14. | Tube heater (heater modes) |
| 15. | Power supply |
| 16. | Battery backup capacity |
| 17. | Carrying case |
| 18. | Dimensions |
| 19. | Weight |
| 20. | Operating condition |
| 21. | Storage condition |
| 22. | No. Of splice cycles with battery |

23. Electrode life

24. Accessories :

Signature of the bidder.

OPTICAL POWER METER TECHNICAL SPECIFICATION

the optical power meter offered should be operatable in windows used in telecommunication system and shall be suitable for measuring the power of optical signal sources and the attenuation of optical cables. the equipment shall be suitable for installation and maintenance of optical links and for component characterization.

TECHNICAL SPECIFICATION:

| | | |
|-----------------------------|---|-------------------|
| WAVELENGTH RANGE | : | 850 TO 1550 NM |
| ACCURACY | : | ± 5% ± 1 NW |
| MEASUREMENT RANGE | : | -70 TO +10 DBM |
| OPERATING TEMPERATURE | : | - 10 TO + 50° C |
| STORAGE TEMPERATURE | : | - 20 TO + 70° C |
| OPTICAL CONNECTOR TYPE | : | FC |
| OPERATING TIME WITH BATTERY | : | AT LEAST 10 HOURS |

OPTICAL POWER METER SHOULD BE OPERATED ON DC VOLTAGE. SUITABLE AC/DC ADAPTER AND BATTERY SHALL BE PROVIDED.

ACCESSORIES ALONG WITH POWER METRE

1. FC/PC, SC/PC, ST/PC INTERCHANGEABLE CONNECTORS
2. BATTERY PACK
3. CARRYING BAG
4. AC/DC ADAPTER.
5. USER GUIDE

GTP FOR OPTICAL POWER METER

| S.NO. | Description |
|-------|--------------------------------------|
| ----- | |
| 1. | WAVELENGTH RANGE : |
| 2. | ACCURACY AT - 30 DBM 23 + 1DEG. C, : |
| | 1550NM : |
| 3. | MEASUREMENT RANGE : |
| 4. | OPERATING TEMPERATURE : |
| 5. | STORAGE TEMPERATURE : |
| 6. | OPTICAL CONNECTOR TYPE : |
| 7. | OPERATING TIME WITH BATTERY : |
| 8. | WEIGHT : |
| 9. | DIMENSIONS : |

**SIGNATURE OF THE BIDDER
WITH SEAL**

TECHNICAL SPECIFICATION FOR OFC TOOL KIT COMPRISING OF FIBRE STRIPPING TOOL AND TOOLS FOR CUTTING AND STRIPPING OF SHEATHING,JACKET ARMOURING OF OFAC/ADSS/OPGW CABLES INCLUDING BINOCULARS (CLEAVER, STRIPPER, BINOCULARS)

I. HIGH PRECISION CLEAVER;

High precision cleaver should have flexible design which permits it to meet variety of cleaving requirements. This cleaver will be used for fusion splicing. Hence the cleaving mechanism should give a splice loss less than 0.02 dB. It should also have the provision to accept fiber holders to support multi-fiber cleaving operations.

II. STRIPPER:

Stripper shall be designed in such a way that all sizes of fibers to remove without scratching or marring the fiber. It is of hardened, precision formed, ground cutting surfaces and having a 0.005" precision laser drilled hole.

TOOLS FOR CUTTING ,STRIPPING,SHEAQTHING , JACKET ARMOURING STRENGTH MEMBERS OF OFAC/ADSS

EACH SET SHOULD CONSISTS OF THE FOLLOWING TOOLS HOUSED IN A STANDARD QUALITY SUITCASE:

- 1.JACKET STRIPPER**
- 2.UNIVERSAL CONTINUITY TESTER**
- 3.BUFFER TUBE STRIPPER**
- 4.ROUND CABLE SLITTER**
- 5.ROUND CABLE CUTTER**
- 6.KEVLAR SCISSORS**
- 7.FIS CONNECTOR CLEANER**
- 8.FOAM SWABS .**
- 9.MATCHING GEL**
- 10.KM WIPES**
- 11.UTILITY KNIFE**
- 12.TWEEZERS**
- 3.NEEDLE NOSE SPLIER**
- 14.PLANO WIRE**
- 15.4 BIT SCREW DRIVER**
- 16.BLACK MARKER**
- 17.SAFETY GLASSES**
- 18.D-GEL WIPES**
- 19.BLACK WORK MAT**
- 20.FIBRE DISPOSABLE UNIT**
- 21.WIRE MARKER DISPENSER**
- 22.RULER**
- 23.FABRIC TAPE MEASURE**
- 24.1/2" NUT DRIVER**
- 25.ECONOMY TIE LABELS**

- 26.FUSION SPLICE SLEEVES(100NOS.)**
- 27. 4GM BLUE DYE EPOXY**
- 28.1MTR. ,3MM FURCATION**
- 29.1MTR.,900UM FURCATION**
- 30. PVC ELECTRICAL TAPE**
- 31. 4OZ ALCOHOL BOTTLE**
- 32. RUGGED CARRY CASE 33. SAFETY BELTS 34.BINOCULARS (2NOS.)**

**TOOLS FOR CUTTING ,STRIPPING ,SHEAQTHING , JACKET ARMOURING
STRENGTH MEMBERS OF OFAC/ADSS**

III. BINOCULARS

Binoculars are required for Monitoring of EHT line Towers and its members and position of Fibre Optic Cable and its accessories fixed to the Tower Members.

Binoculars should able to be provide clear picture / image over a minimum distance of 1000 mts. It should also meet the following parameters.

- i) Magnification : 10 x or better
- ii) Diameter of the front lens : 50 MM or more
- iii) Complete water proof proteciton
- iv) Dry Nitrogen – purged and sealed to prevent frogging, clouding and moisture damage.
- v) Fully multi – coated optics which maximizes light transmission for superior brightness and clarity.
- vi) BAK-4 prisms for crisp and clear images.
- vii) Extreme close focus distance.
- viii) Wide field of view
- ix) Optimum long eye relief with twist-up eye-cups.
- x) Large Knurled center focus knob for precise focusing.
- xi) Textured and rugged shock-absorbing rubber armor
- xii) Non-slip and ergonomic rubber design for a secure grip.
- xiii) Solid and sturdy construction.
- xiv) Deluxe carrying case and neck strap.

ANNEXURE
GTP FOR BINOCULARS

| S.No. | Description |
|-------|------------------------------|
| 1. | Make & Model : |
| 2. | Magnification : |
| 3. | Diameter of the Front lens : |
| 4. | Water proof protection : |
| 5. | Focus distance : |
| 6. | Clear view Distance(kms) : |
| 7. | Maximum Viewing distance. : |
| 8. | Shock absorbing Mechanism : |
| 8. | Prisms design : |
| 9. | Carrying case : |

Signature of the bidder
with official seal

TECHNICAL SPECIFICATION OF OPTICAL TIME DOMAIN REFLECTOMETER (OTDR)

To install & maintain optical fiber system and for auto fiber analysis the optical time domain reflectometer (otdr) is required. The otdr offered should be rugged and easy to use with intelli-trace facility. It should be designed to stand the rigors of field work, while providing precise measurements on single mode or multimode optical fiber systems.

Technical characteristics:

| | | |
|--|---|---|
| Optical characteristics | : | :1550 nm optical output 1550 +/- 20 nm loss threshold 0.02 db minimum loss resolution : 0.001 d b |
| Dynamic and measurement range | : | dynamic range measurement range 5/35 d b 28/28 d b |
| 1310 /1550 nm | | |
| Readout resolution(horizontal) | : | 0.1m minimum |
| Distance measurements | : | kilometres, feet, miles |
| Otdr distance range settings | : | single mode - 1 to 240 km multi mode - 1 to 40 km |
| System measurement accuracy | : | distance - +/- 4 m loss : +/- 0.01 db |
| Distance resolution | : | :25 cm to 40 m |
| Measurement points (horizontal) | : | upto 160000 |
| Vertical scale | : | 0.1 to 10.0 db/div |
| Read out resolution (vertical) | : | 0.001 db |
| Reflectance range (vertical) | : | -14db to - 60db |
| Distance accuracy | : | +/- 1.25.m |
| Reflectance range | : | -14db to - 60 db |
| Measurement time (intelli trace technology) | : | less than 3 minutes (20 d b accumulated loss) |
| Dead zone for 1310 & 1550 nm | | |
| single mode | : | event dead zone attenuation dead zone 3 m 10/12 m |
| Display | : | color screen vga-lcd |
| Selectable pulse widths | : | 10ns, 30ns, 100ns, 300ns, 1μs, 3μs and 10 μs |
| Memory capacity | : | 100 traces in internal memory with 3.5 Inch floppy disk drive. With internal Memory 2mb |
| Output ports | : | rs-232 serial, centronics parallel port, keyboard ps2 (min – din) |

| | |
|-----------------------|---|
| Power | : ac 100-240 vrms ± 10%, 50-60hz. |
| | dc operation |
| | battery operation : should be provided |
| | With rechargeable battery pack (5 hours |
| | of operation typical, depending on |
| | operating mode) |
| Operating temperature | : 0°C to 50°C |
| Storage temperature | : -40°C to +60°C |
| Accessories | : ac/dc adapter, power cord, nimh Battery pack, user's manual, rs232 cable, shoulder strap, carrying case |

Gtp particulars for OTDR

| s.no. | Description | |
|-------|--|--|
| 1. | Optical characteristics | : |
| 2. | Dynamic and measurement range 1310 /1550 nm | : |
| 3. | Readout resolution(horizontal) | : |
| 4. | Distance measurements | : |
| 5. | Otdr distance range settings | : |
| 6. | System measurement accuracy | : |
| 7. | Distance resolution | : |
| 8. | Measurement points (horizontal) | : |
| 9. | Vertical scale | : |
| 10. | Read out resolution (vertical) | : |
| 11. | Reflectance range (vertical) | : |
| 12. | Distance accuracy | : |
| 13. | Reflectance range | : |
| 14. | Measurement time | : |
| 15. | Dead zone for 1310 & 1550 nm single mode | event dead zone attenuation dead zone |
| 16. | Display | : |
| 17. | Selectable pulse widths | |
| 18. | Memory capacity | : |
| 19. | Output ports | : |
| 20. | Power | : |
| 21. | Operating temperature | : |
| 22. | Storage temperature | : |
| 23. | Accessories whether included (yes/no) | : |

Signature of the bidder

**TECHNICAL SPECIFICATION
FOR
SUPPLY OF 48V/ 50A (1 + 1) SMPS MODULAR
POWER SYSTEM**

Technical Specification For 48v/50A(1+1) SMPS

1.0 Scope:

1.1 This Specification Covers The Design, Manufacture, Testing, Inspection And Testing Before Supply And Delivery At Destination Stores Basis Of Following 48v Chargers And D.C. Distribution & Switching Cubicle Required For Communication Equipment At 220kv And 132 Kv Substations.

(I). 48v/50a Smps(1+1) With D.C. Distribution & Switching Cubicle

1.2. It is not intent to specify completely herein all the details of the design and construction of material. However the material shall conform in all respects to high standards of engineering design and workmanship and shall be capable of performing in continuous commercial operation up to the Bidder's guarantee, in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered material shall be complete will all components necessary for their effective and trouble free operation. Such, components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.

2.0 STANDARDS:

2.1 The Design, Manufacture And Testing Of Various Equipments Covered By This Specification Shall Comply With The Following Indian Standards Unless Other-Wise Specified In The Specification.

| Indian Standards | Title |
|---------------------------|--|
| Battery Charger | |
| Is 7204(Part-1)/1974/1991 | Stabilized Power Supplies Dc Output Part: Terms And Definitions |
| Is 7204(Part-2)/1990/1991 | Stabilized Power Supplies Dc Output Part-2: Rating And Performance |
| Is 7204(Part-3)/1980/1991 | Stabilized Power Supplies Dc Output Part-3 Radio Frequency Interference Test |
| Is 7204(Part-4)/1980/1991 | Stabilized Power Supplies Dc Output Part-4 Tests Other Than For Radio Frequency Interference |
| Is 3895/1961 | Monocrytalline Semiconductor Rectifier |

Cells And Stacks

Is4540/1968/1991

Monocrystalline Semiconductor Rectifier
Assemblies And Equipment

Dc Distribution

Is5039/1983/1991

Distribution Feeders For Voltages Not
Exceeding 1000v Ac And 1200 V Dc
(First Revision) (Amendment I)

Is2675/1983/1991
(Second Revision)

Enclosed Distribution Fuse Board And
Output For Voltages Not Exceed 1000v
Ac Or 1200v Dc

Fuses:

Is9224(Part-4/1980/1991)

Low Voltage Fuses Part 4:
Supplementary Requirement For Fuse
Link For The Production Of Semi
Conductor Devices

Is13703(Part-1)/1993
Iec 269-1/1986

Low Voltage Fuses For Voltages Not
Exceeding 1000v Ac Or 1500v Dc.
Part:1: General Requirement
(Superseding Is9224 (Part-1)/1979)

Material Conforming To Other Internationally Accepted Standards, Which Ensure Equal Or Higher Quality Than The Standards Mentioned Above Would Be Acceptable. In Case The Bidders Who Wish To Offer Material Conforming To The Other Standards, Salient Points Of Difference Between The Standards Adopted And The Specific Standards Shall Be Clearly Brought Out In Relevant Schedule. Copies Of Such Standards With Authentic English Translations Shall Be Furnished Along With The Offer.

3.0 Climatic Conditions:

3.1. The Material Called In This Specification Are Required To Operate Satisfactorily Under The Following Climatic Conditions.

| | | |
|-------|---|-----------------|
| I. | Location | :Andhra Pradesh |
| II. | Max Ambient Air Temperature(Deg.C) | : 50 |
| III. | Minimum Ambient Temperature(Deg C) | : 7.5 |
| IV. | Average Daily Ambient Air Temp(Deg.C) | : 35 |
| V. | Maximum Relative Humidity(%) | : 74 |
| VI. | Average Annual Rainfall(Mm) | : 925 |
| VII. | Maximum Wind Measure(Kg/M2) | : 200 |
| VIII. | Max Attitude Above Mean See Level(M) | : 1000 |
| IX. | Ceraunic Level (Days/Year) | : 40 To 50 |
| X. | Seismic Level (Horizontal Acceleration) | : 0.10g |

4.0 Principal Parameters:

4.1.1 general:

- A) Cabinet : I. 48v/50 A Dc Smps Modular Based Supply System Comprising Of Charger With 1 + 1, Dc Distribution & Switching Cubicle. The Charger Shall Be Provided With Multiple Modules Of Equal Capacity. The Capacity Of All The Modules Put Together To Meet The Total Capacity Of 50 A. Smps Charger Shall Be Of 1+1 Configuration. The System Should Be Design With Two Identical Float Cum Boost Chargers Interconnected Through A Switching Cubicle And 48v Dc Distribution Panel. In Case Of Fault In Any One Of The Chargers Feeding The Load, The Switching Cubicle Shall Be Provided With Manual Change Over Facility To Transfer The Load To The Other Charger. The Charger Shall Suit To Connect The 48v Smf Batteries Or Lead Acid Battery System.
- II. Smps Charger And Dc Distribution & Switching CUBICLE SHALL BE SUPPLIED IN THREE CABINETS OF UNIFORM HEIGHT AND DEPTH SO AS TO BE ALIGNED AND BOLTED TOGETHER ON THE SAME FOUNDATION CHANNEL SIDE BY SIDE. THEY SHALL BE FASTENED TOGETHER WITH BOLTS AND NUTS SO AS TO ENABLE THEM TO BE SEPARATED WHEN REQUIRED FOR REPAIRS. FREE STANDING TYPE FLOOR MOUNTING TYPE BOTTOM CABLE ENTRY, REAR SIDE ACCESS FOR WIRING AND CONNECTIONS.

- | | |
|----------------------|------------------------------|
| B) Type Of Cooling | :Natural Air Cooling |
| C) Temperature Range | :0 To 50 Deg C. Of Operation |
| D) Humidity | : 0% To 95% |

5.1 Technical Requirements

5.2 Smps

- 5.2.1. The Battery Charging Plant Consists Of
1) Smps Chargers With Manual Change Over Facility.
2) D.C. Distribution & Switching Cubicle.

5.2.2. Requirements Of Battery Charging Plant:

The Battery Charging Plant Shall Ensure 48v Dc Supply To Plcc Equipment And Telephone Switching Equipment And Should Be Able To Charge The Battery Floating Across The Dc Output Terminals.

5.2.3 Equipment Ratings And Electrical Parameters:

5.2.4 Smps

Input Specifications

| | |
|---------------------|------------------------------------|
| Nominal Voltage | : 230 V Ac, Single Phase |
| Voltage Range | : 150 - 275 V Ac |
| Frequency | : 47 – 53 Hz |
| Power Factor | : 0.98 Min.(50% Load To 100% Load) |
| Efficiency | : >90% |
| Dielectric Strength | : 1.5 Kv Ac (I/P To O/P & Case) |

Input 230v Ac+ 60 Volts To -70 Volts/Single Phase (Ie. Varying Ac From 160v Ac To 290 Vac)

5.2.4.1. Output Specifications

| | |
|---------------------------|--|
| Nominal Voltage | : 54v Dc |
| Output Voltage Adjustment | : 48v - 56v |
| Output Current | : 50a (With Multiple Modules Of Equal Capacity For Each Charger) Full Load Capacity Of 50a. |
| Power | : < 0.5v |
| Output Voltage Regulation | : < 100mv P –P |
| Ripple | : < 2mv |
| Psophometric Noise | : |
| Audible Noise | : |
| Battery Current Limit | : 0.1ah Of Battery |
| Battery Protection | : Lvd (43– 44v) |
| Efficiency | : > 92% |

In Addition To The Above, The Unit Should Have Facility To Charge The 48 V Station Batteries Under Manual Control In Constant Current Mode Of Charging At Any Rate Of Charge Between 20% And 60% Of The Rated Charging Current From A Terminal Voltage Of -58v (2.4v/Cell) To A Terminal Voltage Of - 65v (Upto 2.7v/Cell)

Under All The Battery Charging Voltage Conditions, Load Voltage Shall Be Maintained Between 49v To 53 V Through Suitable Number Of Dropper Diodes.

5.2.4.2 Output: Constant Voltage Mode: Constant Voltage In The Range Of -50 To 56 V Dc At Any Value Of Load Current, From 0 % To 100% Of The Rated Full Load. Facility To Manually Adjust The Output Voltage (By Potentiometer) Is To Be Provided.

5.2.4.3 In Case Of Using With Maintenance Free Sealed Lead Acid Batteries, Constant Voltage For Charging The Battery Will Be Set In The Range 53 To 55v. Battery Charging Current Limit In The Battery Path Should Be Provided For This Application And This Will Be Set In The Range 20 To 50a Amps For 48v/50a Smps. The Unit Shall Have Soft Start Features And Should Not Have Any Tendency To Hunt Irrespective Of The Input And Load Conditions.

5.2.4.4 Constant Current Mode: In Addition To The Above, The Unit Should Have The Facility To Charge The 48v Stationary Batteries Under Manual Control To A Terminal Voltage Of 2.4v/Cell (-58v) From The Discharged Condition Of 1.85v/Cell

(-44.4v) Under Constant Current Mode At Any Rate Of Charge Between 25% And 100% Of The Rated Charging Current.

5.2.4.5. Current Rating :50amps For 48v/50a Smps(1+1) ,

5.2.4.6 Protection & Control: The Following Protection & Controls Should Be Provided

- 1). Ac Input Rotary Switch (On-Off)
- 2). Hrc Fuses For Dc Output
- 3). Dc Output Adjust Potentiometer
- 4). Battery Isolation Switch
- 5). Dropper Diodes Selector Switch
- 6). Low Voltage Sensitive Relay To Isolate Load From The Battery During Main Voltage Failure Or Chargers Failure When The Battery Is Drain To The Level Of -44 .4 V (I.E. 1.85 Per Cell).

5.2.4.7. Equipment Over Voltage: The Smps Charger Should Trip And Give An Eov Indication By Led Flash 'On' And An Alarm When The Load Voltage Exceeds 55v. It Can Be Switched. "On" Only After Manual Resetting Of The Eov - Reset Push Button.

5.2.4.8 Supervision And Alarms: The Following Visual Led Indications Should Be Provided On Units With Marking.

Monitoring & Metering Display

1. Ac Fail
2. Battery Low
3. Ac On Battery Discharged
4. Battery Reverse
5. Module Fail
6. Load On
7. Battery On
8. System On Float
9. System On Charge

5.2.4.9. Fault Alarms Should Be Actuated In Any One Or More Of The Following Conditions.

- I. Charger Failure.
- II. Dc Output High/Low Beyond Limits (Eov/Battery Low)
- III. Over Load
- IV. A.C. Input Failure

5.2.4.10. (I). Digital Dc Voltmeter (0-75v Range) To Be Connected Across The Battery And Load Through A Switch.
(II). Digital Dc Ammeter (0-50a Range For 48v/50a Smps)
(III). Battery Ammeter (50-0-50a Range For 48v/50a Smps) (Central Zero)

5.2.5 D.C. Distribution & Switching Cubicle

5.2.5.1. Dc Distribution Arrangement Should Be Essentially Provided For

- A). Termination Of Plcc Loads
 - B). Termination Of 48v Stationery Battery/Smf Batteries
 - 5.2.5.2 A) Adequately Rated, Insulated Copper Bus Bars Should Be Provided For Charging Bus And Load Bus.
 - B) Switch Is To Be Provided To Isolate The Battery From The Charging Bus.
 - C). Suitable Cable Glands Are To Be Provided For All The External Cables.
 - D). 16 Nos. Of 6a Mcb's In Negative Potential Line, Feeding Various Dc Loads Are To Be Provided. The Positive Wires Are To Be Brought To A Common Terminal.
 - E). 4 Nos. Of 230v/Ac 6a Single Phase Outputs With Mcb Protection In Each Circuit To Be Provided.
 - F). Both The Chargers Are Generally In On Condition With One Of The Chargers Feeding The Load. Battery Is Always Floated Across The Charging Bus Load & Battery Should Be Transferred To The Hot Stand By Unit Automatically Without Any Break Of Dc Supply Even For Milliseconds.
- 5.2.6 During The Period The Main Ac Voltage Is Cut-Off And The Battery Feeding The Load Current A Voltage Sensitive Relay Should Be Provided To Cut Off The Supply To The Battery, Once It Is Drained To The Level Of -44.4v(I.E) 1.85 Per Cell) The Guaranteed Technical Particulars To Be Ensured Is Enclosed In Annexure I . Bidders Are Requested To Indicate Guaranteed Technical Particulars Separately In The Same Format.

Annexure – I

Guaranteed Technical Particulars For 48V/ 50A (1 + 1) SMPS Multiple Modular Power System (To Be Filled By Bidder)

S.No. Description

| | |
|----|--------------------------------------|
| 1. | Manufacturer's Type Designation |
| 2. | Manufacturer's Address |
| 3. | Input Specifications |
| | Nominal Voltage : .. |
| | Voltage Range : .. |
| | Frequency : .. |
| | Power Factor : .. |
| | Efficiency : .. |
| | Dielectric Strength : .. |
| 4. | Output Specifications |
| | Nominal Voltage : .. |
| | Output Voltage Adjustment : .. |
| | Output Current Per Module : .. |
| | No. Of Modules For Each 50a Capacity |
| | Power : .. |
| | Output Voltage Regulation : .. |
| | Ripple : .. |
| | Psophometric : .. |
| | Audible Noise : .. |
| | Battery Current Limit : .. |
| | Battery Protection : .. |
| 5. | General Specifications |
| | Weight : Approx. : .. |
| | Dimensions : .. |
| | Enclosure : .. |
| | Operating Temperature : .. |
| | Storage Temperature : .. |
| | Cooling : .. |
| | Humidity : .. |
| 6. | A Alarms & Indicators |
| 7. | Protections Provided |

Signature Of The Bidder

Annexure
Schedule Of Guaranteed And Other Technical Particulars
Dc Distribution & Switching Cubicle

I General

1. Manufacturer's Name & Address :
.....
2. Supplier's Name & Address :
3. Governing Standard
4. Capacity Rating
A) Rated Voltage (Volts) :
.....
- B) Rated Current (Amps.) :
.....
5. Symmetrical Short Circuit Withstand Current (Ka)
.....
And Duration
6. Degree Of Protection As Per Is:2147
A) Dc Distribution & Switching Cubicle :
.....
- B) Bus-Bar Chamber. :
.....
7. Cubicle Sheet Metal Thickness For (Mm) :
.....
Front, Rear, Sides And Top.
8. Painting Shade As Per Is:5
A) External Surface :
B) Internal Surface :
9. Standard Height, Width & Depth (Mm) :
.....
Dc Distribution /Switching Cubicle
10. Width Of Cable Alley (Mm) :
.....
11. Earth Bus-Bar Size And Material. :
.....
12. Recommended Dynamic Loading For
.....
Foundation Design.
13. Approximate Weight Of Dc (Kg) :
.....
Distribution & Switching Cubicle
14. Is Extension Possible In Future. :
.....
15. Lifting Hooks Provided :Yes/No
16. Dimensional Outline Drawing Enclosed : Yes/No

II. Busbars And Insulators

1. Material :
2. Bare/Painted/Epoxy Insulated Sleeved :
3. Minimum Clearance (Mm) :
4. Continuous Current Rating At Ambient Temperature (50°C.) :
5. Cross-Section Provided For
A) Horizontal Busbar (Sq.Mm) :
B) Vertical Busbar (Sq.Mm) :
6. Short Time Current Rating For Ka :
1 Sec. :
7. Material Of The Support :
Insulators. :
8. Temperature Rise Over Ambient :
Temperature(50°C) For Continuous Current Rating (Deg.C) :

III. Contactors

1. Voltage Rating :
2. No. Of Poles :
3. Rated Voltage Of Main And Auxiliary Contacts:
4. Limits Of Operation
A) Supply Voltage Variation ($\pm\%$) :
B) Drop Out Voltage (V) :
5. Rated Breaking Capacity (Ka) :
6. Rated Making Capacity (Ka) :
7. Rated Thermal Current (Ka) :
8. Maximum Recommended Back Up :
Hrc Fuse Size. :

IV. Auxiliary Contactor

1. Voltage Rating (Volts) :
2. Coil Voltage (Volts) :
3. Coil Burden (Va) :
4. No. Of Contacts And Their Rating :

V. Control/Selector Switch

1. Voltage Rating :
2. Type Of Handle :

3. Number Of Contacts :
4. Rating Of Contacts :
5. No. Of Positions :

Vi. Push Buttons

1. Contact Type :
2. Voltage Rating :
3. Number Of Contacts :

4. Contact Rating :
.....

Vii. Space Heater

1. Rated Voltage (Volts) :
2. Rated Power (Kw) :
3. Thermo State Setting Range (Deg.C) :

Viii. Wiring And Terminal Blocks

A. Wiring

1. Voltage Grade :
2. Material Of Wire And Solid/Stranded Conductor
.....
3. Type Of Insulation :
4. Minimum Size Of Conductor For
A) Power Wiring (Sq.Mm) :
B) Control Wiring (Sq.Mm) :

B. Terminal Blocks

1. Type Of Control Terminal Block On
A) Fixed Portion And Draw Out Portion
.....
B) Switchgear And Breaker :
.....
2. Type Of Terminal Blocks :
.....
3. Current Rating Of Terminal Blocks :

Ix. Indicating Lamps

1. Voltage :
.....
2. Series Resistor Value And Rating :
.....
3. Max. Burning Hours :

4. Certificate Mark (Is Or Any Other) :

X. Indicating Instruments :

Voltmeter (Range And Accuracy Class) :

Ammeter (Range And Accuracy Class) :

Scale Details :

Scale Cramping, If Any :

Xi. Mcbs/Mccb's

Continuous Current Rating :

Rated Breaking Capacity :

Wire Size Which The Terminal Can Accommodate :

Padlocking Facility Provided : Yes/No

Signature Of Manufacturer/Supplier
Name & Address

Signature Of The Bidder:

Place : Name:

Date : Designation:
Name Of The Company:

**TECHNICAL SPECIFICATION
FOR
SUPPLY OF 48V/ 35A (1 + 1) SMPS MODULAR
POWER SYSTEM**

1.0 GENERAL:

A) CABINET : I)The complete system should be designed such that it should provide 1+1 redundancy with DCDB distribution.

- ii) with high level of corrosion resistant in warm and humid climates including outdoor and long term use. And coating should resist to mineral oils , lubricants, solvents, alkaline.. Etc.
- iii) all ms / stainless sheets and components should be carefully selected for out door application for power and thermal management.
- iv) door stopper and ip gasket seal , door switch and inside lamp.

V) with high security locking facility system.

Vi) various types of (input/output)cables are pre-specified and provision for connectors should be installed on to the base plate . This should allow easy cable termination at site/sub-station without drilling.

1.1 features:

48v/35a (1 + 1) smps modular hot-pluggable rectifier modules or modules with same capacity to meet total capacity of 35 a.in each charger to have (1+1) separation.

- I) Should be modular hot swapable
- II) This SMPS base modular dc system should be convenient , reliable and suitable for telecom, (PLCC) applications.
- III) The systems are generally built with common control block and display block
- IV) The system should have the configuration of float cum boost chargers. These modular system should provide paralleling of modules to each load requirements and redundancy factors.
- V) Should be designed to support to suitable for all kinds of batteries like smf, lead acid, vrla, nickle cadmium or modular battery sets of 48v to 54 v dc.
- Vii) 48v dc / 35 a modular dc supply system comprising of float cum boost charger with 1 + 1 standby dc distribution / switching cubicle. The system shall be based on smps modular with two identical float cum boost chargers interconnected through a switching cubicle and 48v dc distribution panel such that in case of fault in any one of the chargers feeding to the load, the switching cubicle shall be provided with manual change over/automatic change over facility to transfer the load to the other charger. The load current shall be shared by all the modules in the charger.

environmental conditions:

- | | |
|---------------------------|------------------------------|
| a) operating temperature: | -5 to 55 deg celcius. |
| b) type of cooling | :natural air cooling |
| c) relative humidity | : 5% to 95% |
| e) colour | :silver ash |

should be designed with over temperature protection and auto re-cover.

1.1 Technical Requirements

1.1.1 FLOAT cum boost charger

- 1.1.2. The battery charging system consists of
1)float cum boost chargers with manual/auto change
over facility.
2) d.c. distribution/switching cubicle.

1.1.3. Requirements of battery charging system:

The battery charging plant shall ensure 48v dc supply to PLCC equipment and telephone switching equipment and should be able to charge the battery floating across the dc output terminals.

1.1.4 Equipment ratings and electrical parameters:

1.1.5 Float cum boost chargers:

input 230v ac+ 60 volts to -70 volts/single phase (ie. Varying ac from 160v ac to 290 vac)

- .1.1.6 . i. In addition to the above, the unit should have facility to boost charge the 48v station batteries under manual control in constant current mode of charging at any rate of charge between 20% and 60% of the rated charging current from a terminal voltage of -58v (2.4v/cell) to a terminal voltage of -65v (upto 2.7v/cell)
- ii. Under all the battery charging voltage conditions, load voltage shall be maintained between 49v to 53 v through suitable number of dropper diodes.
- 1.1.7 output: constant voltage mode: constant voltage in the range of -50 to 56 v dc at any value of load current, from 0 % to 100% of the rated full load. Facility to manually adjust the output voltage (by potentiometer) is to be provided.
- 1.1.8. In case of using with maintenance free sealed lead acid batteries, constant voltage for charging the battery will be set in the range 53 to 55v. Battery charging current limit in the battery path should be provided for this application and this will be set in the range 15 to 35a amps for 48v/35afcfc and 20 to 50a for 48v/50a fcfc. The unit shall have soft start features and should not have any tendency to hunt irrespective of the input and load conditions.
- 1.1.9. Constant current mode: in addition to the above, the unit should have the facility to charge the 48v stationary batteries under manual control to a terminal voltage of 2.4v/cell (-58v) from the discharged condition of 1.85v/cell (-44.4v) under constant current mode at any rate of charge between 25% and 100% of the rated charging current.

1.1.9 current rating : 35amps for 48v/35a fcfc(1+1) .

- 1.2.0 .output voltage drop: when the total current(battery + load) of the charger goes beyond 100% of the rated current, the output terminal voltage should fall sharply at or before 105% of the rated current, to a value below-47v.
- 1.2.1 .ripple voltage should be less than 4mv on resistive load without battery and 2 mv with battery.
- 1.2.1 .voltage regulation + /- for currents between zero and full load and mains voltage variations of + /- 10%
- 1.2.2 i. Efficiency not less than 75% of full rated load
ii. Power factor not less than 0.8% lag
III.total current limit (load + battery) fixed at 105% of the rated current capacity of the charger.
- 1.2.3. . Insulation not less than 5 meg ohms in any of the following cases.
i) between dc output terminals and ac input terminals
ii) between dc output terminals and earth
iii)between ac input terminals and earth
- .2.4. . Protection & control: the following protection & controls should be provided voltage sensitive design to isolate load from the battery during main voltage failure or chargers failure when the battery is drain to the level of -44 .4 v(i.e. 1.85 per cell).
- 1.2.5.. Equipment over voltage: the fcfc charger should trip and give an eov indication by led flash 'on' and an alarm when the load voltage exceeds 55v. It can be switched. "on" only after manual resetting of the eov - reset push button.
- 1.2.6. Supervision and alarms: the following visual led indications should be Provided on units with marking.
A) On-green
B) Off/mains fail-amber
C) Fault-red
- 1.2.7. Fault alarms should be actuated in any one or more of the following conditions.
A) fuse failure.
B) Dc output high/low beyond limits (eov/battery low)
C) Over load
D) A.c. input failure
E) Float cum boost charger I&II fail
F) Control card fuse fail
- 1.2.8. (i).digital dc voltmeter (0-75v range) to be connected across the battery and load through a switch.
(ii).Digital ammeter (0-50a range for 48v/35a fcfc)
(iii).digital battery ammeter (35-0-35a range for 48v/35a fcfc and)(- ve current ,zero ,+ve current displays for maintaining battery system.)

1.3.0 D.C. distribution/switching cubicle

- I) switching arrangement should be essentially provided for
 - A) Termination of PLCC loads
 - B) Termination of 48v stationery battery/SMF batteries
 - ii) a) adequately rated, insulated copper bus bars should be provided for charging bus and load bus.
 - b) switch is to be provided to isolate the battery from the charging bus.
 - C) Suitable cable glands are to be provided for all the external cables.
 - D) 12 nos. Of 6a mcb's in negative potential line, feeding various dc loads are to be provided. The positive wires are to be brought to a common terminal.
 - E) 4 nos. Of 230v/ac 6a single phase outputs with MCB protection in each circuit to be provided.
 - F) Both the chargers are generally in on condition with one of the chargers feeding the load. Battery is always floated across the charging bus load & battery should be transferred to the hot stand by unit automatically without any break of dc supply even for milliseconds.
- 1.4.0 during the period the main ac voltage is cut-off and the battery feeding the load current a voltage sensitive relay should be provided to cut off the supply to the battery, once it is drained to the level of -44.4v(i.e 1.85 per cell)

The guaranteed technical particulars to be ensured is enclosed in annexure i . Bidders are requested to indicate guaranteed technical particulars separately in the same format.

1.5.0 : the bidder should provide operating procedures and manual.

2.0 technical specification for 48v/35a (1 + 1) smps modular power system, which uses hot-pluggable rectifier modules of equal capacity in each charger to have (1+1) separation.

2.1 input specifications

| | |
|---------------------|------------------------------------|
| Nominal voltage | : 230 vac, single phase |
| Voltage range | : 150 - 275 vac |
| Frequency | : 47 –53 hz |
| Power factor | : 0.98 min.(50% load to 100% load) |
| Efficiency | : >90% |
| Dielectric strength | : 1.5 kv ac (i/p to o/p & case) |

2.2 output specifications

| | |
|---------------------------|--|
| Nominal voltage | : 54v dc |
| Output voltage adjustment | : 48v - 56v |
| Output current | : multiple modules or modules with same capacity to meet total capacity of 35 a in each charger. |
| power | : 1950 - 2000w (max.) |
| Output voltage regulation | : < 0.5v |
| Ripple | : < 100mv p –p |

| | |
|-------------------------------|----------------------------|
| Psophometric noise | : < 2mv |
| Audible noise | : |
| Battery current limit | : 0.1ah of battery |
| Battery protection efficiency | : lvd (43– 44v) : > 92% |

2.3 general features

- modular systems, easy for maintenance
- hot plug-in modules
- wide input voltage range
- active current sharing
- potential free contacts for remote fault annunciation
- power factor correction
- input high voltage disconnect (HVD) & battery low voltage disconnect (LVD)
- analog controller
- common o/p voltage control
- battery current limiting for each battery path (presettable to suit battery capacity).

2.4 Monitoring & Metering Display

1. Ac fail
2. Battery low
3. Ac on battery discharged
4. Battery reverse
5. Module fail
6. Load on
7. Battery on
8. System on float
9. System on charge
- 10.indication of load on main (or) stand by

2.5 Digital Panel Meters Provided For-

- 1.battery voltage
2. Load voltage
3. Battery current
4. Load current

2.6 AC & DC distribution board

1. 12 nos. of mcbs of 5amps each should be provided at load side
2. 4 nos. of ac mcbs of 5a each should be provided
3. Switch for isolation of battery from charger should be provided.

2.7 alarms & indicators shall be provided for the following features:

- A) Fuse failure:
- B) Dc output high/low beyond limits (eov/battery low):
- C) Over load:
- D) A.c. input failure:
- E) Float cum boost charger i & ii fail:

2.8. The following protection features shall be provided :

- A) Isolation of the load from battery during battery drain level of the battery in main supply failure conditions and charger failure conditions.
- B) Mcb protection provided to ac supply and dc supply :
- C) Fuses provided for ac & dc supply control & protection:

Annexure - i

Guaranteed technical particulars for 48v/ 35a (1 + 1) smps modular power system which uses hot- pluggable rectification modules of equal capacity for total capacity of 35 amps. (to be filled by bidder)

| S.no. | Description |
|--------------|---|
| 1. | Manufacturer's type designation |
| 2. | Manufacturer's address |
| 3. | Input specifications Nominal voltage : Voltage range : Frequency : Power factor : Efficiency : Dielectric strength : |
| 4. | Output specifications Nominal voltage : Output voltage adjustment : Output current per module : No. Of modules for each 35a capacity Power : Output voltage regulation : Ripple : Psophometric : Audible noise : Battery current limit : Battery protection : |
| 5. | General specifications Weight :approx. : Dimensions : Enclosure:,: Operating temperature : Storage temperature : Cooling : Humidity : |
| 6. | alarms & indicators provided yes/no: |

- A) Fuse failure:
- B) Dc output high /low beyond limits(eov /battery low):
- C) Over load:
- D) A.c. input failure:
- E) Float cum boost charger i & ii fail:

7. protections provided battery system(yes /no) and specify voltage:

a) isolation of the load from battery during battery drain level of the battery:
in main supply failure conditions and charger failure conditions.

B) mcb protection provided to ac supply :

C) fuses provided for ac & dc supply control & protection:

8. Whether monitoring indications & meetering display provided (yes/no)

1. Ac fail
2. Battery low
3. Ac on battery discharged
4. Battery reverse
5. Module fail
6. Load on
7. Battery on
8. System on float
9. System on charge
- 10.indication of load on main (or) stand by

signature of the bidder

Technical specification for 48v sealed maintenance Free VRLA batteries

1.0. This specification covers the design, manufacture, testing, inspection and testing before supply and delivery at destination stores basis of following 48v sealed maintenance free vrla battery sets for communication equipment at 132kv substations.

(i). 48v/200ah sealed maintenance free vrla battery set

1.1. It is not intent to specify completely herein all the details of the design and construction of material. However the material shall conform in all respects to high standards of engineering design and workmanship and shall be capable of performing in continuous commercial operation up to the bidder's guarantee, in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered material shall be complete will all components necessary for their effective and trouble free operation. Such, components shall be deemed to be within the scope of bidder's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.

2.0 standards:

2.1 The design, manufacture and testing of various equipments covered by this specification shall comply with the following indian standards unless otherwise specified in the specification.

| Indian standards | title |
|--|--|
| <u>Battery sets:</u> | |
| Iss1885/1986 (part-viii) | electro technical vocabulary |
| Iss 1651/1991 (third revision) is1652-1984 | secondary cells and batteries. Stationary cells and batteries, lead acid type (with tubular positive plates) sealed maintenance free batteries |
| Iec: 896-2/part-ii | valve regulated type bsen 60896-2 |

material conforming to other internationally accepted standards, which ensure equal or higher quality than the standards mentioned above would be acceptable. In case the bidders who wish to offer material conforming to the other standards, salient points of difference between the standards adopted and the specific standards shall be clearly brought out in relevant schedule. Four copies of such standards with authentic english translations shall be furnished along with the offer.

3.0 climatic conditions:

3.2. The material called in this specification are required to operate satisfactorily Under the following climatic conditions.

| | | |
|-------|---|-----------------|
| i. | Location | :andhra pradesh |
| ii. | Max ambient air temperature(deg.c) | : 55` |
| iii. | Minimum ambient temperature(deg c) | : 7.5 |
| iv. | Average daily ambient air temp(deg.c) | : 35 |
| v. | Maximum relative humidity(%) | : 74 |
| vi. | Average annual rainfall(mm) | : 925 |
| vii. | Maximum wind measure(kg/m2) | : 200 |
| Viii. | Max attitude above mean see level(m) | : 1000 |
| ix. | Ceraunic level (days/year) | : 40 to 50 |
| x. | Seismic level (horizontal acceleration) | : 0.10g |

4.0. Principal parameters:

4.1. 1+1 battery sets ie two sets , Each set consisting of following specifications:

| | | |
|-----|---|--|
| A) | no. Of cells per battery bank | 24 nos. |
| B) | nominal voltage of each cell | 2 volts |
| C) | nominal voltage of the complete bank | 48 volts |
| D) | type of plates in each cell positive plates | low corrosion and low self Discharge alloy |
| | negative plates | low corrosion & maintenance free alloy |
| E) | terminals | integral solid copper core |
| F). | Connectors | lead plated copper connectors |
| g.) | Capacity of batteries (in amp battery set Hours at 10 hour rate to at 27 deg. an end voltage Of 1.85v per cell) | 200ah at 27 deg.c for 48v/200ah |
| h) | cell dimensions and designation | designation to be specified |
| | In accordance with the standard | by the bidder and maximum over all dimensions as per relevant standards. The bidder shall provide adequate thickness for the container to avoid any damages in transit & during installation particularly outer sides of the container where name plate and other details are pressed |
| i) | proposed method of working | float charge and boost charge |
| j) | mounting | rack mounted stack |
| k) | type of installation | in-door |

Note:- each cell should be properly packed in separate insulated metal container stack.

5.0 Technical requirements

5.1 battery:

5.1.2. The batteries required under this specification are for supplying dc supply to power line carrier communication equipment. The battery shall be capable of withstanding large discharge currents for operating various equipments. It shall be of rugged construction designed for long life and for working satisfactorily

without much alteration under the severest operating conditions and shall conform to the relevant standards.

- 5.1.3. The battery shall be supplied complete with all accessories including inter cell, inter row and inter bank connectors and bolts, nuts & washers.**
- 5.1.4. The battery shall be offered complete with all parts that are necessary or useful for their efficient operation. Such parts shall be deemed to be within the scope of this specification**
- .
- 5.1.5. The guaranteed technical particulars to be ensured is enclosed in annexure i. Bidders are requested to indicate gtp separately in the same format.**

ANNEXURE

**SCHEDULE OF GUARANTEED AND OTHER TECHNICAL PARTICULARS FOR
SEALED MAINTENANCE FREE VRLA BATTERIES 48V/200AH**

1. MANUFACTURER'S NAME, ADDRESS AND COUNTRY:
.....
2. Supplier's name and address :
3. Governing standard :
4. Cell designation :
5. Plates :
thickness and material :
I) type of positive plate :
Thickness and material :
II) type of negative plate :
III) number of plates per cell :
6. Separators
(I) type :
(ii)material :
(iii)thickness :
(iv)governing standard :
7. Vent plug
(I) constructional details :
(II) Material :
(III) Operating pressure range :
(IV) Governing standard :
8. Container
(I) Type :
(II) Material :
(III) Governing standard :
9. Open circuit voltage of each cell (volts) when completely discharged at 27 °c
(I) At 10 h discharge rate :
(II) At 1 h discharge rate :
10. Recommended range of float/boost charging voltage (start/finish)
per cell and permissible variations
11. Float/boost charger current (a) :
12. Amount of gas (h2) evolved during boost charging :
13. Internal resistance of each cell. (ohm)
i) fully charged :
.....
ii)fully discharged. :

14. Maximum temperature that cell (deg. C.) shall withstand continuously without affecting the service life of cell over ambient temp. Of
- 27°C
- 50°C
15. Loss of life when battery operated various temperature corresponding to ambient temp. Of
- 27°C
- 50°C
16. Average life of cell in years. :
17. Overall dimension of each cell (mm x mm x mm) :
18. Distance between the centres of cell when erected. :
19. Weight of complete cell (kg.) :
20. Size and material of connectors with
Method of connection between cells. : ..
(installation & connection diagrams to be enclosed)
21. Capacity of battery at (amp-hour)
I) ten hour discharge rate to 1.85v : ..
..... per cell at 27 deg.c.
ii) five hour discharge rate to 1.85v : ..
..... per cell at 27 deg.c.
iii) one hour discharge rate to 1.85v : ..
..... per cell at 27 deg.c.
iv) one minute discharge rate to 1.85v: ..
..... per cell at 27 deg.c.
22. Max. Recommended period of storage : ..
..... before refreshing charge
23. Battery racks
I) Type of material : ..
.....
II) Out line dimensions : ..
.....
III) Process of painting and type of coating : ..
.....
iv) net weight (kg.) : ..
.....
24. Insulator material for isolating battery stack from ground and cell

25. Short circuit current at battery terminals. :
.....
26. Time for which the battery can withstand short circuit at :
.....
terminals
27. Recommended maximum rating of fuse for :
.....
protection of battery.
28. Size of cable recommended for connections :
.....
of battery to battery charger, dc distribution
board.
29. Recommended interval at which battery :
.....
should be discharged at 10 hour
discharge rate and boost charged.
30. Efficiency
(a) ah efficiency (%) :
.....
(b) wh efficiency (%) :
.....
31. Inter connectors
a) type of inter cell to cell and tier to tier connectors :
.....
b) material of inter cell to cell and tier to tier connectors:
.....
c) type of inter stack connectors :
.....
d) material of inter stack connectors :
.....
32. Total shipping weight of one battery unit (kg) yes/no
33. Charging characteristics (enclosed) yes/no
34. capacity retention characteristics (enclosed)

35 **enclosures**

- i) whether all the drawings and technical literature for battery enclosed yes/no
- ii) whether type test reports enclosed yes/no
- iii) whether the painting shall be done as per seven tank method

Signature of the bidder:

Place: name:

Date: designation:

signature of manufacturer/supplier

Name & address name of the company

ANNEXURE-I
GUARANTEED TECHNICAL PARTICULARS FOR
48V/200AH SEALED MAINTENANCE FREE VRLA BATTERY SETS
(TO BE FILLED BY BIDDER)

| S.no. | Description |
|-------|--|
| 1. | Type of designation as per ISS |
| 2 | manufacturer's type designation |
| 3 | manufacturer's address |
| 4. | Ampere hour capacity at 10 hours rate Of discharge a) no. Of positive plates per cell B) No. Of negative plates per cell |
| 5. | Total no. Of plates per cell |
| 6. | Discharge current and cell end voltage for the battery A).1 minute load B).1 hour load C).2 hour load D).3 hour load E).5 hour load F).8 hour load G).10 hour load |
| | (please furnish a graph showing amps against time for the type of battery offered) |
| 7. | Nominal cell voltage (volts) |
| 7. | No. Of cells in each bank |
| 8. | Internal resistance for each cell (micro ohms) |
| 9. | Resistance of the battery including Inter-connection between the cells(ohms) |
| 10. | Short circuit current (amps) |
| 11. | Material of containers |
| 12. | Thickness, type and material of separators |
| 13. | A. Construction details and dimensions I. Positive plate Ii .negative plate b. Method of supporting elements |
| 14. | Surface area of plates, sq.mm |
| 15. | Clearance between edges of plates and |
| 17. | Inner surface of container (incase of lead Lined wooden container clearance between Edges of plates and hangers) mm |
| 18 | clearance between bottoms of negative plates And bottom of container mm |
| 18 | clearance between top of plates and top Of container mm |

| | | | |
|----|--|------|-------|
| 19 | sediment space (depth)mm | | |
| 20 | dimensions of each cell | | |
| | Length, mm | | |
| | Width, mm | | |
| | Height, mm | | |
| 22 | thickness of container, mm | | |
| 23 | distance between centers of cells where erected mm | | |
| 24 | net. Weight of the cell complete with acid kg | | |
| 25 | a) ampere hour efficiency % | | |
| | B) watt hour efficiency % | | |
| 26 | recommended float charge current and voltage | amps | volts |
| 27 | recommended boost charge current and voltage | amps | volts |
| 28 | time required for boost charging from discharged Condition | | |
| 29 | maximum charging current/cell | amps | |
| 30 | nominal charging rate | amps | |
| 31 | maximum charging rate | amps | |
| 32 | type of inter-cell connection | | |
| 33 | type of spray arrestors | | |
| 34 | type of stand | | |
| 35 | type of supporting insulators | | |
| 36 | whether explosion proof or vent plugs provided | | |
| 37 | expected life span of battery | | |
| 38 | proposed layout | | |
| 39 | rack details | | |
| | A) No. Of units | | |
| | B) Description | | |
| | C) Unit weight(shipping) kgs | | |
| | D) Unit length mm | | |
| | E) Unit width mm | | |
| | F) Unit height mm | | |
| 40 | ventilation required in battery room | | |

signature of the bidder

TECHNICAL SPECIFICATION FOR 48V SEALED MAINTENANCE FREE VRLA BATTERIES

1.2. This specification covers the design, manufacture, testing, inspection and testing before supply and delivery at destination stores basis of following 48v sealed maintenance free VRLA battery sets for communication equipment at 220kv and 132 kv substations.

(i). 48v/250AH sealed maintenance free vrla battery set

1.3. it is not intent to specify completely herein all the details of the design and construction of material. However the material shall conform in all respects to high standards of engineering design and workmanship and shall be capable of performing in continuous commercial operation up to the bidder's guarantee, in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered material shall be complete will all components necessary for their effective and trouble free operation. Such, components shall be deemed to be within the scope of bidder's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.

2.0 standards:

2.1 the design, manufacture and testing of various equipments covered by this specification shall comply with the following indian standards unless otherwise specified in the specification.

| Indian standards | title |
|-----------------------------------|---|
| <u>Battery sets:</u> | |
| Iss1885/1986 (part-viii) | electro technical vocabulary |
| Iss 1651/1991 (third revision) | secondary cells and batteries. Stationary cells and batteries, lead acid type (with is1652-1984 |
| Iec: 896-2/part-ii | tubular positive plates) sealed maintenance free batteries valve regulated type bsen 60896-2 |

material conforming to other internationally accepted standards, which ensure equal or higher quality than the standards mentioned above would be acceptable. In case the bidders who wish to offer material conforming to the other standards, salient points of difference between the standards adopted and the specific standards shall be clearly brought out in relevant schedule. Four copies of such standards with authentic english translations shall be furnished along with the offer.

3.0 climatic conditions:

3.2. The material called in this specification are required to operate satisfactorily Under the following climatic conditions.

| | | |
|-------|---|------------------|
| I. | Location | : Andhra Pradesh |
| II. | Max ambient air temperature(deg.c) | : 55` |
| III. | Minimum ambient temperature(deg c) | : 7.5 |
| IV. | Average daily ambient air temp(deg.c) | : 35 |
| V. | Maximum relative humidity(%) | : 74 |
| VI. | Average annual rainfall(mm) | : 925 |
| VII. | Maximum wind measure(kg/m2) | : 200 |
| VIII. | Max attitude above mean see level(m) | : 1000 |
| IX. | Ceraunic level (days/year) | : 40 to 50 |
| X. | Seismic level (horizontal acceleration) | : 0.10g |

4.0. Principal parameters:

4.2. 1+1 battery sets ie two sets ,
Each set consisting of following specifications:

| | | |
|-----|--|---|
| A) | no. Of cells per battery bank | 24 nos. |
| B) | nominal voltage of each cell | 2 volts |
| C) | nominal voltage of the complete bank | 48 volts |
| D) | type of plates in each cell positive plates | low corrosion and low self Discharge alloy |
| | negative plates | low corrosion & maintenance free alloy |
| E) | terminals | integral solid copper core |
| F). | Connectors | lead plated copper connectors |
| g). | Capacity of batteries(in amp Hours at 10 hour rate to an end voltage Of 1.85v per cell) | 250ah at 27 deg.c for 48v/250ah battery set |
| h) | cell dimensions and designation In accordance with the standard | designation to be specified by the bidder and maximum over all dimensions |
| | | as per relevant standards. The bidder shall provide adequate thickness for the container to avoid any damages in transit & during installation particularly outer sides of the container where name plate and other details are pressed |
| i) | proposed method of working | float charge and boost charge |
| j) | mounting | rack mounted stack |
| k) | type of installation | in-door |

Note:- each cell should be properly packed in separate insulated metal container stack.

5.0 technical requirements

5.1 battery:

5.1.6. The batteries required under this specification are for supplying dc supply to power line carrier communication equipment. The battery shall be capable of withstanding large discharge currents for operating various equipments. It shall be of rugged

construction designed for long life and for working satisfactorily without much alteration under the severest operating conditions and shall conform to the relevant standards.

- 5.1.7. The battery shall be supplied complete with all accessories including inter cell, inter row and inter bank connectors and bolts, nuts & washers.
- 5.1.8. The battery shall be offered complete with all parts that are necessary or useful for their efficient operation. Such parts shall be deemed to be within the scope of this specification
- 5.1.9. The guaranteed technical particulars to be ensured is enclosed in annexure i. Bidders are requested to indicate gtp separately in the same format.

ANNEXURE

**SCHEDULE OF GUARANTEED AND OTHER TECHNICAL PARTICULARS FOR
SEALED MAINTENANCE FREE VRLA BATTERIES**

Sealed maintenance free VRLA batteries : 48V/250AH

1. Manufacturer's name, address and country:
2. Supplier's name and address :
3. Governing standard :
4. Cell designation :
6. Plates :
thickness and material :
I) type of positive plate :
Thickness and material :
II) type of negative plate :
III) number of plates per cell :
6. Separators
(II) type :
(ii)material :
(iii)thickness :
(iv)governing standard :
7. Vent plug
(V) constructional details :
(VI) Material :
(VII) Operating pressure range :
(VIII) Governing standard :
8. Container
(IV) Type :
(V) Material :
(VI) Governing standard :
9. Open circuit voltage of each cell (volts) when completely discharged at 27 °c
(III) At 10 h discharge rate :
(IV) At 1 h discharge rate :
10. Recommended range of float/boost charging voltage (start/finish)
per cell and permissible variations
11. Float/boost charger current (a) :
12. Amount of gas (h2) evolved during boost charging :
13. Internal resistance of each cell. (ohm)

- i) fully charged :
.....
ii) fully discharged. :
14. Maximum temperature that cell (deg. C.) shall withstand continuously without affecting the service life of cell over ambient temp. Of
- 27°C
- 50°C
15. Loss of life when battery operated various temperature corresponding to ambient temp. Of
- 27°C
- 50°C
16. Average life of cell in years. :
17. Overall dimension of each cell (mm x mm x mm) :
18. Distance between the centres of cell when erected. :
19. Weight of complete cell (kg.) :
20. Size and material of connectors with Method of connection between cells. :
-
(installation & connection diagrams to be enclosed)
21. Capacity of battery at (amp-hour)
I) ten hour discharge rate to 1.85v :
-
per cell at 27 deg.c.
ii) five hour discharge rate to 1.85v :
-
per cell at 27 deg.c.
iii) one hour discharge rate to 1.85v :
-
per cell at 27 deg.c.
iv) one minute discharge rate to 1.85v:
-
per cell at 27 deg.c.
22. Max. Recommended period of storage :
-
before refreshing charge
23. Battery racks
IV) Type of material :
-
V) Out line dimensions :
-
VI) Process of painting and type of coating :
-
iv) net weight (kg.) :
-

24. Insulator material for isolating battery stack from ground and cell
25. Short circuit current at battery terminals :
.....
26. Time for which the battery can withstand short circuit at :
.....
terminals
27. Recommended maximum rating of fuse for :
.....
protection of battery.
28. Size of cable recommended for connections :
.....
of battery to battery charger, dc distribution
board.
29. Recommended interval at which battery :
.....
should be discharged at 10 hour
discharge rate and boost charged.
30. Efficiency
(a) ah efficiency (%) :
.....
(b) wh efficiency (%) :
.....
31. Inter connectors
a) type of inter cell to cell and tier to tier connectors :
.....
b) material of inter cell to cell and tier to tier connectors:
.....
c) type of inter stack connectors :
.....
d) material of inter stack connectors :
.....
32. Total shipping weight of one battery unit (kg) yes/no
33. Charging characteristics (enclosed) yes/no
34. capacity retention characteristics (enclosed)

35 **enclosures**

- i) whether all the drawings and technical literature for battery enclosed yes/no
- ii) whether type test reports enclosed yes/no
- iii) whether the painting shall be done as per seven tank method

Signature of the bidder:

Place: name:

Date: designation:

signature of manufacturer/supplier

Name & Address Name of the company

**TECHNICAL SPECIFICATION
FOR
6 Pair & 1 Pair Telephone Cables**

TECHNICAL SPECIFICATION FOR 6 Pair & 1 Pair Telephone Cables

1.0 **SCOPE:**

1.1. The scope of the specification covers design, manufacture, testing, Packing, forwarding and delivery on fads basis of cables as detailed below:-

- i. 0.63mm 6 pair un-armoured telephone cable
- ii. 0.63mm single pair un-armoured telephone cable.

1.3. Six pair and single pair telephone cables are intended to interconnect the switching equipment to power line carrier communication terminal and interconnecting the switching equipment to telephone instruments. The telephone cables will carry voice and data signals with frequencies below 4 khz. The cables are intended for indoor use only.

2.0 **standards:**

(i). The cables proposed for purchase shall conform to the following i.s. standards which shall mean latest revisions, amendments/changes adopted and published unless otherwise specified herein after.

| ----- | standards | title | ----- |
|---------------|-----------|-------|-------------------------|
| cables | | | <u>telephone</u> |

Is10579/
Is5831/84

polythene insulation and sheath of
pvc insulation and sheath of electrical cables

Equipment meeting with the requirement of other authoritative standards, including is which ensure equal or better performance than the standards mentioned above, shall also be considered. When the equipment offered by the bidder conforms to other standards, salient points of difference between standards adopted and the standards specified in this specification shall be clearly brought out in the relevant schedule. Four copies of such standards with authentic translation in english shall be furnished along with the offer.

3.0 **climatic condition :**

3.1. The cables called in this specification are required to operate satisfactorily as per the service conditions setout in the annexure of this specification.

4.0 **Principal parameters:**

4.2. **Six pair/single pair cable**

| | | | |
|-----------|------------------------------|---|---|
| 4.2.1. | Type of cable | : | telephone cable |
| 4.2.2. | Voltage grade | : | 300v |
| 4.2.3. | conductor material | : | annealed tin copper |
| 4.2.4. | Conductor size | : | 0.63mm +/- 0.1mm |
| 4.2.5. | Conductor resistance | : | 57 ohms/km |
| 4.2.6. | Conductor elongation (%) | : | 20.0 (min) |
| 4.2.7. | Insulation material | : | solid medium density polythene |
| 4.2.8. | Insulation thickness | : | 0.25 mm nominal |
| 4.2.9. | Max. Dia of insulation core: | : | 1.2 mm |
| 4.2.10. | Overall sheath material | : | extruded pvc st-1 Is:5831/84 |
| 4.2.11. | High voltage | : | 2 kv rms for 1 minute |
| 4.2.12. | Capacitance unbalanced | : | 250 pf (max) |
| 4.2.13. | Packing length / coil | : | 100 m +/- 5% coil |
| 4.2.14. | Overall sheath thickness : | | |
| | 6 Pair | : | 1.4mm nominal |
| | single pair | : | 1.0 mm nominal |
| 4.2.15. | Overall dia. Of cable | | |
| | 6 pair | : | 8.0 mm |
| | single pair | : | 5.5 mm |
| | insulation material | : | pvc type a of is:5831/84 |
| 4.3.5. | Thickness of insulation | : | 1.2mm nominal |
| 4.3.6. | Approx. Cable outer dia | : | 9.5 mm nominal |
| 4.3.7. | Max. Cr at 20 deg.c. | : | 0.95 ohms/km |
| 4.3.8. | Volume resistivity | : | 1×10^{12} ohms/cms at 20 deg.c |
| 4.3.9. | High voltage test | : | 3.0 kv for 5 minutes between conductor and ground |
| 4.3.10 | rls type | | category c1 |
| 4.3.10.1. | oxygen index | : | as per astmd 2963 |
| 4.3.10.2. | temperature index | : | not less than 25°C |

5.2. 6 pair & single pair telephone cables

- 5.2.1 The telephone cables shall be made up of 0.63 mm diameter annealed, high conductivity copper conductor, polythene insulated, 2 cores twisted to form pairs all pairs bundled and wrapped together with teflon paper. Overall pvc sheathed unarmoured telephone cable generally conforming to is:1554-part-i.
- 5.2.2 Cable shall be designed and manufactured so that damage will not result from transportation, installation and operation under any/or all the climatic and operating conditions to which they may be subjected. The conductor in every single core of the cable shall withstand an external voltage of 300v.

6.0. **Tests**

- 6.1. The type tests carried out on the offered cables should be in accordance with is:5026-

1969, is:11967(part.2/sec.2)/89,

6.1.1. The bidder along with his bid shall furnish type test certificates for the tests specified in clause no.6.2.0 below for the equipment offered by him. The type tests should have been conducted on particular type & model of the equipment i.e., offered by the bidder against this specification by a reputed independent laboratory and the satisfactory performance of the said equipment should have been certified by the laboratory.

The bids of bidders not accompanied by the type test certificates as stated above will be treated as incomplete and termed as non-responsive and liable to be rejected.

Type tests shall mean those tests, which are to be carried out to prove the process of manufacture and general conformity of the material to this specification.

6.2.0. Type tests

6.2.2. 6 pair and 1 pair cables

- i) resistivity of conductor
- ii) dielectric strength of insulator
- iii) insulation resistance
- iv) spark test
- v) high voltage test
- vi) hot deformation
- vii) elongation test
- viii) tensile strength test

6.3.2. Telephone cables

- i) dimensions
- ii) insulation resistance
- iii) elongation test
- iv) tensile test
- v) high voltage test
- vi) conductivity test / shrinkage
- vii) thermal stability test

6.4. **Routine tests**

6.4.2. Telephone cables

- i) dimensions
- ii) insulation resistance
- iii) elongation test
- iv) tensile test
- v) high voltage test
- vi) conductivity test/ shrinkage

6.5. Testing expenses

The entire cost of testing for the acceptance and routine tests and tests during manufacture specified herein shall be treated as included in the quoted unit price of

6.6. Additional tests:

The purchaser reserves the right of having at his own expenses any other test(s) of reasonable nature carried out at bidder's premises, at site, or in any other place in addition to the aforesaid type, acceptance and routine tests, to satisfy himself that the material comply with the specifications.

6.7. Test reports:

6.7.1. Copies of test reports shall be furnished in at least six (6) copies along with one original. One copy shall be returned duly certified by the purchaser only after which the material will be dispatched.

6.7.2. Record of routine test reports shall be maintained by the bidder at his works for periodic inspection or as and when desired by the purchaser's representative.

6.7.3. Test certificates of tests conducted during manufacture shall be maintained by the bidder. They shall be produced for verification as and when desired by the purchaser.

6.8. Test facilities

6.8.1. The following additional test facilities shall be available at bidder's works:

- a) various testing and measuring equipment shall be provided.
- b) standard resistance for calibration of resistance bridges.

**GUARANTEED TECHNICAL PARTICULARS
FOR TELEPHONE CABLES**

6pair/1pair

- 1) manufacturer name & address:
 - 2) suppliers name & address :
 - 3) governing standards :
 - 4) voltage grade :
 - 5) no. Of pairs :
 6. Conductor
 - a) material :
 - b) size :
 - c) resistance :
 - d) elongation :
 7. Insulation
 - a) material :
 - b) thickness :
 - c) max.dia of core :
 - d) resistance :
 - e) colour code :
 8. Pair lay length :
 9. Core wrapping :
 10. Moisture barrier :
 11. Overall sheath
 - a) material :
 - b) thickness :
 - c) colour :
 12. Overall dia of cable :
 13. High voltage :
 14. Packing length :
 15. Rip cord
 16. Capacitance unbalanced :
 17. Type test certificates enclosed (yes/no) :
-

Date :

Place :

Signature of manufacturer/supplier
Name & address

signature of the bidder
name :

Whether authorised attorney
Of the tendering company

Name of the tendering company with seal

ANNEXURE – I

Climatic conditions

| | | |
|-------|--|-------------------------------|
| I. | Maximum ambient temperature (degree c) | 45 |
| II. | Minimum ambient air temperature (degree c) | 5 |
| III. | Daily average ambient temperature (degree c) | 32 |
| IV. | Max.relative humidity | 74% |
| V. | Annual rain fall (max) mm | 1500 |
| VI. | Rainy days in a year (days) | june to October – 120 days |
| VII. | Basic wind speed m/sec | 44 |
| VIII. | Maximum altitude above mean sea level (meters) | 1000 |
| IX. | Seismic level (horizontal acceleration) | 0.03 |
| | (vertical acceleration) | 0.015 |
| X. | Average number of thunder storm days per year | : |

**TECHNICAL SPECIFICATION
FOR
SUPPLY of 25 Sq mm Battery Cables**

TECHNICAL SPECIFICATION FOR CABLES FOR PROVIDING PLCC/OFC COMMUNICATION ON TRANSMISSION LINES TO SUBSTATIONS

1.0 SCOPE :

1.1. the scope of the specification covers design, manufacture, testing, Packing, forwarding and delivery on fads basis of cables as detailed below:-

I) 25 sq.mm. Battery cable.

1.4. The battery cable is intended to interconnect the (-)48v dc battery to battery charger and plcc equipment carrying currents of about 100 a battery cables are intended for indoor use only.

2.0 **standards:**

(i). The cables proposed for purchase shall conform to the following i.s. standards which shall mean latest revisions, amendments/changes adopted and published unless otherwise specified herein after.

| ----- | standards | title | ----- |
|---------------------------------|-----------|--|-------|
| | | battery cable | |
| Is1554(part1)/ 1988 category | | pvc insulated (heavy duty) electric cable part-1,for working voltages up to and including 1100v. | |
| Is 8130/1984 | | conductors for insulated electric cables and flexible cables. | |
| Is5831/1984 | | pvc insulation and sheath of electric cable. | |

Equipment meeting with the requirement of other authoritative standards, including is which ensure equal or better performance than the standards mentioned above, shall also be considered. When the equipment offered by the bidder conforms to other standards, salient points of difference between standards adopted and the standards specified in this specification shall be clearly brought out in the relevant schedule. Four copies of such standards with authentic translation in english shall be furnished along with the offer.

3.0 **climatic condition :**

3.2. The cables called in this specification are required to operate satisfactorily as per the service conditions setout in the clause no.23 of

section-iii of this specification.

4.0. **Principal parameters:**

| | | |
|---------------|---|--|
| 4.3.0. | <u>25 sq. Mm single core multistrand battery cable</u> | |
| 4.3.1. | Type of cable | : 25 sq.mm frls type category c1 conforming to is 1554(part1)battery cable |
| 4.3.2. | Conductor material | :multistrand annealed high conductivity bare copper as per is:8130/84 |
| 4.3.3. | No. Of strands in the conductor /dia of each strand | : 209/0.4 mm |
| 4.3.4. | Insulation material | : pvc type a of is:5831/84 |
| 4.3.5. | Thickness of insulation | : 1.2mm nominal |
| 4.3.6. | Approx. Cable outer dia | : 11.0 mm nominal |
| 4.3.7. | Max. Cr at 20 deg.c. | : 0.95 ohms/km |
| 4.3.8. | Volume resistivity | : 1×10^{12} ohms/cms at 20 deg.c |
| 4.3.9. | High voltage test | : 3.0 kv for 5 minutes between conductor and ground |
| 4.3.11 | rls type | category c1 |
| 4.3.12 | oxygen index | :as per astmd 2963 |
| 4.3.13 | temperature index | :not less than 25°C |

5.0. **General technical requirements**

| | |
|---------------|--|
| 6.2.3. | 25 sq.mm battery cable |
| I) | dimensions |
| II) | elongation test |
| III) | tensile test |
| IV) | insulation resistance test |
| V) | high voltage test |
| VI) | flammability test |
| VII) | spark test |
| VIII) | resistivity of the conductor |
| IX). | Oxygen index and temperature rise test as per astmd-2863. The minimum value of oxygen index shall be 29. |
| X). | Flame retardant test on single cable. |
| XI). | Rodent and termite proof test. |

6.3.0. **Acceptance tests**

| | |
|---------------|---------------------------|
| 6.3.1. | Battery cables |
| | i) dimensions |
| | ii) insulation resistance |

- iii) elongation test
- iv) tensile test
- v) high voltage test
- vi) conductivity test / shrinkage
- vii) thermal stability test

6.4.

6.4.1.

Routine tests

Battery cable

- i) dimensions
- ii) insulation resistance
- iii) elongation test
- iv) tensile test
- v) high voltage test
- vi) conductivity test/ shrinkage

6.5.

Testing expenses

the entire cost of testing for the acceptance and routine tests and tests during manufacture specified herein shall be treated as included in the quoted unit price of cables.

6.6.

Additional tests:

The purchaser reserves the right of having at his own expenses any other test(s) of reasonable nature carried out at bidder's premises, at site, or in any other place in addition to the aforesaid type, acceptance and routine tests, to satisfy himself that the material comply with the specifications.

6.7.

6.7.1.

Test reports:

Copies of test reports shall be furnished in at least six (6) copies along with one original. One copy shall be returned duly certified by the purchaser only after which the material will be dispatched.

6.7.2.

Record of routine test reports shall be maintained by the bidder at his works for periodic inspection or as and when desired by the purchaser's representative.

6.7.3.

Test certificates of tests conducted during manufacture shall be maintained by the bidder. They shall be produced for verification as and when desired by the purchaser.

6.8.

Test facilities

- 6.8.1. The following additional test facilities shall be available at bidder's works:
- various testing and measuring equipment shall be provided.
 - standard resistance for calibration of resistance bridges.

**guaranteed technical particulars
for battery cable
(to be filled by the bidder)**

| tests | 25 sq.mm |
|--|-----------------|
| 1. Manufacturers name & address | ; |
| 2. Suppliers' name & address | ; |
| 3. Governing standards | ; |
| 4. Type of cable | ; |
| 5. Category of cable | ; |
| A. Oxygen index (reference standard) | : |
| B. Temperature index(reference standarsd): | |
| 6. no. Of core | : |
| 7. Voltage rating | : |
| 8. Conductor/strands | |
| a) material | : |
| b) diameter | : |
| c) no. Of strands | : |
| 9. Insulation | |
| a) material | : |
| b) thickness | : |
| c) tolerance on thickness | : |
| d) colour of core | : |
| 10. Approx.cable outer dia. | : |
| 11. Construction details | : |
| 12. Other constructional details | : |
| 13. Min. Installation radius | : |
| 14. Electrical test | |
| a) max.cr at 20 deg.c. | : |
| b) volume resistivity at 27 deg.c . | : |

c) high voltage :
15. Packing length :
16. Whether type test certificates enclosed: yes/no

Date : _____

Place :

Signature of manufacturer/supplier signature of the bidder

Whether authorised attorney of the

Tendering company

Tendering company
Name of the tendering company with seal

Technical specification for 1.5ton split air conditioner

- 1.0. **Climatic conditions:**
 1.1 the material called in this specification are required to operate satisfactorily under the following climatic conditions.

| | | | |
|-------|---|---|----------------|
| I. | Location | : | andhra pradesh |
| II. | Max ambient air temperature(deg.c) | : | 50 |
| III. | Minimum ambient temperature(deg c) | : | 7.5 |
| IV. | Average daily ambient air temp(deg.c) | : | 35 |
| V. | Maximum relative humidity(%) | : | 74 |
| VI. | Average annual rainfall(mm) | : | 925 |
| VII. | Maximum wind measure(kg/m2) | : | 200 |
| VIII. | Max attitude above mean see level(m) | : | 1000 |
| IX. | Ceraunic level (days/year) | : | 40 to 50 |
| X. | Seismic level (horizontal acceleration) | : | 0.10g |

2.0 essential features

The ac units supplied should be provided with the following essential features:-

1. Capacity : 1.5 ton (4500kcal/hr) split air conditioner of standard company make .
2. Stabilizer of capacity : 4kva of standard company make
3. **Ac supply source for above ac unit:** 1 no. Mdb with 32a mcb with electrical wiring using 2.5sqmm control cable approximate distance of 10 to 15 mtrs from ac distribution panel to communication room and complete erection and commissioning of the unit.
4. On / off timer
5. Auto restart
6. Operation control – electronic
7. Capacity :

Annexure-i
**Guaranteed technical particulars
 For split air conditioner units
 (to be filled by bidder)**

| Sl. No. | Description | Data |
|------------|--|------------|
| 1 | Make & type | |
| 2. | Power supply | Volts a.c. |
| 3. | Power consumption | Watts |
| 4. | Compressor capacity | K.cal/hr. |
| 5. | Cooling capacity | K.cal/hr |
| 6. | Fan motor rating | K.watts |
| 7. | Speed of compressor | Rpm |
| 8. | (i).refrigerant (ii).weight of refrigerant charged into the unit | |
| 9. | Cabinet dimensions | mm |
| 10. | front panel dimensions | mm |
| 11. | Total mass | kgs |
| 12. | Noise level of air conditioners (indoor) | db |
| 13. | Confirm whether testing facilities as per is: 1391 (part-i)-1992 are available at the bidders's premises. If the answer is 'no' indicate the address of the location with details where the tests are proposed to be conducted. | yes/no. |
| 14. | I). Current drawn from the ac mains when starting from idle (start current) II) current drawn from the ac mains during running (running current) | A |
| 15. | Air delivery of condenser fan at full speed of rated voltage | M3/hr |
| 16. | Exhaust air quantity | M3/hr |
| | | |

Date :

signature of the bidder

Place :

name of the tendering company with seal

Annexure - ii

**Guaranteed technical particulars
For 230v ac stabilizer units
(to be filled by bidder)**

| Sl. No. | Description | Data |
|------------|---------------------------|------|
| 1. | Make & type | |
| 2. | Input ac volts (range) | |
| 3. | Output ac volts | |
| 4. | Capacity | |
| 5. | Efficiency at full load | % |
| 6. | Regulation | % |
| 7. | High volt cut off : volts | |
| 8. | Low volt cut off : volts | |
| 9. | Time delay : minutes | |

Date :

signature of the bidder

Place :

name of the tendering company with seal

SECTION – VI
QUALIFICATION REQUIREMENTS
Bid No. e-LIPT-15/2012-JB JICA LOT I &II 3-3

1. The bidder must have successfully supplied and executed on turnkey basis at least 40% of the tendered quantity of the OPGW & Under ground 48F unarmoured Optical Fibre Cable, OLTE & Digital teleprotection couplers of same or higher class indicated in the “Schedule of Requirement” in one continuous period of 12 months. The offered make of equipment of the package shall also be erected & commissioned and in successful operation for at least two years as on the date of bid opening and its financial turnover during any one year of the last five years should have been equal or more than 100% value of the package now quoted.

At least 20% of the quantity of the OPGW Optical Fibre Cable & Under ground 48F unarmoured Optical Fibre Cable, OLTE & Digital teleprotection couplers and other offered equipment supplied and erected as mentioned in Schedule of Requirement against this Specification should be in successful operation for at least 2 years(a continuous period of 24 months) , as on the date of opening of the Bid.

2. The bidder should furnish the information on all past supplies and satisfactory Performance along with proof of documents in the form of Form(7). The supply and service record claimed by the bidder shall be supported by the performance certificates issued by a Senior Officer of the utility to which the equipments is supplied, erected and commissioned thereupon.
3. The bidder shall furnish Type test results. The type tests must have been conducted on the material offered as per the relevant IS in recognized laboratory as per the latest revision of the technical specification and the date of type tests will not be later than 10 years subject to no alteration in the design. The bids received without type tests will be treated as non-responsive. If any change in design was made latest type tests shall be furnished along with approved drawings.
3. Bids of bidders quoting as authorized representative of a manufacturer should furnish the manufacturer authorization in the prescribed form(6) of section-VI assuring full guarantee and warrantee obligations
4. All bids submitted will also include the following information:
 - i. Copies of original documents defining the constitution or legal status, place of registration and principle place of business of the company or firm or partnership, etc.,
 - i. The bidder should furnish a brief write-up, backed with adequate data, explaining his available capacity and experience (both technical and commercial) for the

- manufacture and supply of the required equipment within the specified time of completion after meeting all their current commitments.
- iii. The bidder should clearly confirm that all the facilities exist in his factory for inspection and testing and these will be made available to the purchaser or his representative for inspection.
 - iv. Reports on financial standing of the Bidder such as profit and loss statement, balance sheets and auditor's report for the past three years, bankers certificates etc.
5. Even though the bidder meets the above qualifying criteria, they are subject to be disqualified if they have...
- a. made misleading or false representations in the forms statements and attachments submitted in proof of qualification requirements and / or
 - b. record of poor performance such as not properly completing the contract, inordinate delays in supply completion, litigation history or financial failure etc.
6. Notwithstanding anything stated above the purchaser reserves the right to assess bidder's capability and capacity to perform the contract should circumstances warrant such an assessment in the overall interest of the purchaser.

SECTION - VII

SAMPLE FORMS

1. BID SECURITY FORM

Whereas (hereinafter called "the Bidder") has submitted its Bid dated (date of submission of bid) for the supply of (name and / or description of the Materials / equipment) (hereinafter called "the Bid").

KNOW ALL PEOPLE by these presents that WE(name of bank) having our registered office at (address of bank) (hereinafter called "the Bank"), are bound unto (name of Purchaser) (hereinafter called "The Purchaser") in the sum of for which payment well and truly be made to the said Purchaser, the Bank binds itself, its successors, and assigns by these presents. Sealed with the common seal of the said Bank this day of 2010.

THE CONDITIONS OF THIS OBLIGATION ARE:

1. If the Bidder
 - a) Withdraws its Bid during the period of bid validity specified by the Bidder on the Bid Form; or
 - b) Does not accept the correction of errors in accordance with the Bid Specification, or
2. If the Bidder, having been notified of the acceptance of its bid by the Purchaser during the period of bid validity.
 - a) fails or refuses to furnish the performance security, in accordance with the Bid Specification.
 - b) Fails or refuses to execute the Contract Form if required; or

We undertake to pay the Purchaser up to the above amount upon receipt of its first written demand, without the Purchaser having to substantiate its demand, provided that in its demand the purchaser will note that the amount claimed by it is due to it, owing to the occurrence of one or both of the two conditions, specifying the occurred condition or conditions.

This guarantee will remain in force up to and including Sixty (60) days after (Specification Date) the period of the bid validity, and any demand in respect thereof should reach the Bank not later than the above date.

.....
(Signature of the bank)

NOTE: This will be executed on a Rs.100/- non-judicial stamp paper issued by a scheduled Bank

2. PERMANENT BID SECURITY FORM(Not applicable . This facility is withdrawn)

Whereas the APTRANSCO has afforded a facility to bidders submitting bids in response to notices of the APTRANSCO calling for bids for supply of materials or rendering of services permitting bidders who furnish a permanent bid security of Rs. 2,50,000/- in the shape of cash / Govt. securities / Bank Guarantees in lieu of cash to have their bids considered without separate payment of bid security with each bid; whereas M/s. _____ (company's name and full address) has offered the guarantee of this _____ bank, the (name of Bank and full address) towards fixed bid security and the APTRANSCO has agreed to accept the same and the obligations of the bidder have been incorporated in agreement dated _____ which will be read as part of this guarantee; we _____ bank Ltd., do hereby undertake to indemnify and keep indemnified the APTRANSCO by reasons of any breach by the bidder afore mentioned of any terms and conditions of any of the bid quotations or the bids submitted by the bidder which are considered by the APTRANSCO in accordance with the terms of the agreement dated _____ or the contract entered into pursuant to such bids.

We (Name of the Bank & full address) further agree that the guarantee herein contained will remain in full force and effect upto and inclusive of the (date of validity) and that it will continued to be enforceable till all the terms and conditions of the APTRANSCO under or by virtue of any of the said bid quotations or bids or contracts have been fully complied with and its claims satisfied or discharged or till all the Chief Engineers of APTRANSCO certify that the terms and conditions of the said bid quotation have been fully and properly carried out by the said M/s. (Name of the Bidder & full address) and accordingly discharge the guarantee subject however that the APTRANSCO will have no right under this bond after the expiry of three (3) years period from the date of its execution. We the guarantor bank undertake to pay the amount guaranteed hereunder or such part thereof as required within one week of the sum being demanded by the APTRANSCO without reference to the supplier and without questioning the right of the demand. We _____ bank Ltd., lastly undertake not to revoke this guarantee during its currency except with the prior consent of the APTRANSCO in writing. Not notwithstanding anything contained in the foregoing our liability under this guarantee is restricted to Rs. 2,50,000/- (Rupees Two lakh fifty thousand only). Our guarantee will remain in force until _____. Unless a claim under this guarantee is made against us within six (6) months from this date all the rights under this guarantee will be forfeited and we will be relieved and discharged from all liability hereunder.

Dated this the _____ day of (month) _____ (year)

From _____ Bank Ltd.,

STATION _____ for _____ (Bank Ltd.,)
Authorized signatories

Note: aBank Guarantee should be furnished on Rs.100/- non judicial stamp paper.

b.The B.G. should be valid for a period of 3 years in the first instance.The date of the agreement will be earlier to or the same as the date of Bank Guarantee.

3. Agreement to Permanent Bid Security(Not applicable. This facility is withdrawn)

Whereas the APTRANSCO has afforded a facility to persons submitting bids in response to notice of the ATRANSCO calling for bids for supply of materials or rendering of services permitting bidders who furnish a permanent bid security for Rs.2,50,000/- (Rupees Two Lakhs fifty thousand only) in the shape of cash / Govt. securities / Bank Guarantee in lieu of cash to have their bids considered without separate payment of bid security with each bid.

Whereas we (name & full address of bidder) herein after called the bidder intend to avail of the said facility and do hereby furnish the fixed permanent bid security of Rs.2,50,000/- in the shape of Bank Guarantee of the (bankers name & address).

IT IS HEREBY AGREED AND DECLARED AS FOLLOWS:

1. The Bank Guarantee furnished herewith will in the first instance be valid for three (3) years.
2. So long as the Bank Guarantee is in force all bids submitted by the bidder in response to notices of APTRANSCO inviting bids will be considered by the APTRANSCO without payment of separate bid security with each bid.
3. If there is any default on the part of the bidder in respect of the bid or the contract resulting there from the APTRANSCO will have the unilateral right to call upon the Bank to forthwith pay to the APTRANSCO a sum equivalent to the damages sustained by the APTRANSCO by reason of such default.
4. Where any such amounts have been claimed from and paid by the Bank, the APTRANSCO will not be bound to consider any bid of the bidder submits thereafter unless the Bank Guarantee is restored to the level of Rs. 2,50,000/- however, in special cases the APTRANSCO may consider any bid before the guarantee is restored to the full amount of Rs.2,50,000/- if a separate bid security is given for the short fall and the bidder undertakes in writing to make good, the short fall in the bank guarantee within 2 months of opening of the bids.

Dated this the _____ day of _____ (month) _____ (year)

STATION _____ Signature of Bidder

NOTE: The Agreement should be furnished on Rs.50/- non judicial stamp paper.

4.CONTRACT FORM

THIS AGREEMENT made the _____ day of _____ 2010 Between _____ (Name of purchaser) of the one part and _____ (Name of supplier) of the other part:

WHEREAS the purchaser invited bids for certain Materials / equipment and ancillary services viz., (Brief description of Materials / equipment and Services) and has accepted a bid by the Supplier for the supply of those Materials / equipment and services in the sum of (Contract price in Words and Figures) (hereinafter called "the Contract Price").

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

1. In this Agreement words and expressions will have the same meanings as are respectively assigned to them in the conditions of Contract referred to.
2. The following documents will be deemed to form and be read and construed as part of this Agreement, viz.,
 - a) The Bid Form and the Price Schedule submitted by the Bidder;
 - b) The Schedule of Requirements;
 - c) The Technical Specifications;
 - d) The General Conditions of Contract
 - e) The Purchaser's Notification of Award.
3. In consideration of the payments to be made by the Purchaser to the Supplier as hereinafter mentioned, the supplier hereby covenants with the Purchaser to provide the Materials / equipment and services and to remedy defects therein in conformity in all respects with the provisions of the Contract.
4. The Purchaser hereby covenants to pay the Supplier in consideration of the provision of the Materials / equipment and services and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

Brief particulars of the Materials / equipment and services which will be supplied/ provided by the Supplier are as under:

| S.NO. | Brief Description of Materials / Equipment & services | Quantity to be supplied | Unit Price Rs. | Total Price Rs. | Delivery Terms |
|-------|---|-------------------------|----------------|-----------------|----------------|
| | | | | | |

| | | | | | | |
|--|--|--|--|--|--|--|
| | | | | | | |
| | | | | | | |

TOTAL VALUE : (Rupees _____ only)

DELIVERY SCHEDULE :

IN WITNESS whereof the parties hereto have caused this Agreement to be executed on the day and year first above written.

Signed, Sealed and Delivered by the

Said For the Purchaser)

In the presence of

Signed, Sealed and Delivered by the

Said For the supplier)

In the presence of

NOTE: To be executed on a Rs. 100/- Non-Judicial stamp paper.

5a. PERFORMANCE SECURITY FORM.

To: (Name of purchaser)

Whereas (Name of Supplier)
 (hereinafter called "the supplier") has undertaken, in pursuance of Contract No. Dated 2010 to supply. (Description of Materials / equipment and services)
 (Hereinafter called "the Contract").

AND WHEREAS it has been stipulated by you in the said Contract that the Supplier will furnish you with a Bank Guarantee by a recognized Bank for the sum specified therein as security for compliance with the supplier's performance obligations in accordance with the Contract.

AND WHEREAS we have agreed to give the Supplier a Guarantee:

THEREFORE WE hereby affirm that we are Guarantors and responsible to you, on behalf of the Supplier, up to a total of (Amount of the Guarantee in words and Figures) and we undertake to pay you, upon your first written demand declaring the Supplier to be in default under the Contract and without cavil or argument, any sum or sums within the limit of (Amount of Guarantee) as aforesaid, without your needing to prove or to show grounds or reasons for your demand or the sum specified therein.

This guarantee is valid until the day of 2010.

Signature and Seal of Guarantors

.....

Date 2010

Address

NOTE: This will be executed on a Rs.100/- non-judicial stamp paper by a scheduled Bank.

5b. BANK GUARANTEE FOR ADVANCE PAYMENT

To: ----- (Name of the Purchaser)
----- (Address of the purchaser)
----- (Name of contract)

Gentlemen:

In accordance with the provision of the conditions of contract, subclause (Advance Payment") of the above mentioned contract, ----- (name and address of supplier) shall deposit with ----- (Name of the purchaser) a bank guarantee to guarantee his proper and faithful performance under the said clause of the contract in an amount of -----(amount of guarantee)**

(in figures and words)

We, the -----(a bank or financial institution), as instructed by the supplier agree unconditionally and irrevocable to guarantee as primary obligator and not as surety merely, the payment to ----- (name of purchaser) on his first demand without whatsoever right of objection on our part and without his first claim to the supplier, in the amount not exceeding -----(amount of guarantee)** -----
-----(in words).

We further agree that no change or addition to or other modification of the terms of the contract or of works to be performed there under or of any of the contract documents which may be made between ----- (name of purchaser) and the supplier, shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

]**An amount is to be inserted by the bank or financial institution representing the amount of the Advance payment, and denominated either in the currency(ies) of the advance payment as specified in the contract, or in a freely convertible currency acceptable to the purchaser.

**An amount is to be inserted by the bank or financial institution representing the amount of the advance payment, and denominated either in the currency(es) of the advance payment as specified in the contract, or in a freely convertible currency acceptable to the purchaser.

This guarantee shall remain valid and in full effect from the date of the advance payment under the contract valid until the purchaser received the goods in good condition i.e acceptance of material by the purchaser from the bidder.

Yours faithfully,

SIGNATURE AND SEAL-----

Name of Bank/Final Institute:-----

Address -----

Date: -----

Note: This shall executed on Rs.100/-non-judoco; stamp paper by domestic bidders only. The Bank guarantee shall be issue by a scheduled Indian Bank or a Foreign Bank located in India. The Bank guarantee issued by the banks should be confirmed by a scheduled Indian Bank or a Foreign Bank.

6.MANUFACTURER'S AUTHORISATION FORM.

NO. **Dated.**

To

Dear Sir,

SPECIFICATION NO.

We who are established and reputable manufacturers of (name & descriptions of Materials / equipment offered) having factories at (address of factory) do hereby authorize M/s. (Name and address of Agent) to submit a bid, and sign the contract with you for the above Materials / equipment manufactured by us against the above Specification No.

We hereby extend our full guarantee and warranty as per Clause 53 of the General Terms & Conditions of Contract for the materials/equipment and services offered by the above firm against this Specification No.

Yours faithfully,

(Name of manufacturer)

NOTE: This letter of authority should be on the letterhead of the manufacturer and should be signed by a person competent and having the power of attorney to bind the manufacturer. It should be included by the Bidder in its bid.

7. PROFORMA FOR PERFORMANCE STATEMENT

Bid No.

Date of Opening

Time Hours

Name of the Firm

| Order placed by (full address of purchaser, Contact person &Phone Number) | Order No. and Date | Date on which contract agreement signed | Description and quantity of ordered equipment | Date of completion of Delivery | |
|---|--------------------------|---|--|--------------------------------|--------|
| | | | | As per Contract | Actual |
| 1 | 2 | 3 | 4 | 5 | 6 |

| Remarks indicating reasons for late delivery, if any | Performance of the equipment | | | Has the equipment been satisfactorily functioning? (Attach a Certificate from the Purchaser) |
|---|------------------------------|--------------------------|--|---|
| | Qty. commissioned | Date of commissioning | Locations of place at which commissioned | |
| 7 | 8 | 9 | 10 | 11 |

Signature of the Bidder

8. DETAILS TO BE FURNISHED BY THE BIDDER

| | | | |
|----|---|---|----------------|
| 1. | Specification No. | : | |
| 2. | Name of the Material | : | |
| 3. | Bidder's vendor Registration No. for this item | : | Not applicable |
| 4 | Quantity to be procured | : | |
| 5 | Last date and time for submission of Bid | : | |
| 6 | Date and time for opening of Bid | : | |
| 7 | State whether Bid guarantee is enclosed towards Bid Security | : | |
| 8 | State whether the quotation is in two part | : | |
| 9 | State whether quoted for entire quantity | : | |
| 10 | Whether willing to furnish performance B.G. @ 10% if order is placed | : | |
| 11 | Details of remittance of Specification cost | : | Not applicable |
| 12 | Whether a local SSI Unit / Local Unit | : | |
| 13 | Whether month wise delivery schedule indicated | : | |
| 14 | Prices whether variable / Firm | : | |
| 15 | Whether any other tax/duty payable. If so give details and the same is included / Not included | : | |
| 16 | State whether APTRANSCO terms of payment are accepted | : | |
| 17 | Quantity offered for supply | : | |
| 18 | State whether 90 days validity offered | : | |
| 19 | Whether sample is enclosed for offered type of 24F ADSS OFC cable | : | |
| 20 | Whether the material / equipment offered conforms to the relevant APTRANSCO Specification | : | |
| 21 | Whether you have executed orders of the APTRANSCO previously for these items. (Please give details) | : | |
| 22 | Similar details in respect of supplies made to other utilities | : | |
| 23 | Whether sales tax clearance certificate enclosed | : | |
| 24 | Whether Income-tax clearance certificate enclosed. | : | |

Signature of the bidder

8(a) PROFORMA FOR REPORT OF RECEIPT OF MATERIALS IN STORES

| Sl.No | Description |
|-------|--|
| 1 | P.O.No and Date |
| 2 | Name of the supplier |
| 3 | Company's reference no. |
| 4 | Date of receipt a) Railway station/Lorry transport b) central stores |
| 5 | Condition of material |
| 6 | Particulars of materials a. as per challan b. b) actually accepted c. short receipt d. breakages/damages |
| 7 | Whether the materials are as per specifications |
| 8 | Reference to a) SRB No.& Date b) T. Note no,& date |
| 9 | Has any railway freight paid to the consignment with weight of the materials as per PO? |
| 10 | Under charges paid, if any |
| 11 | Demurrgages/wharfages paid, if any |
| 12 | Handling charges paid, if any |
| 13 | Siding charges paid, if any |
| 14 | Railways crane charges paid, if any |
| 15 | Date of check measurement |
| 16 | By whom check measures |
| 17 | Agency of transport |
| 18 | Has the supply been made in time? If not, indicate the delay in number of days |
| 19 | Whether from "C" issued |
| 20 | If so, the no & date for Rs |
| 21 | If not, why the form 'C' is not issued |
| 22 | Bill/invoice no.& date for Rs |
| 23 | Date of receipt of LR/RR in store |
| 24 | RR/LR received from supplier/central office |
| 25 | Whether the test certificates was approved by the component authority |

Remarks of the check measurement officer

AE/AAE
(TLC stores)

Check measured by:

Counter signed

Asst. Executive Engineer

;

**8(b) PROFORMA CERTIFICATE FOR ISSE BY THE PURCHASER AFTER
SUCCESSFUL COMMISSIONING OF COMMUNICATION EQUIPMENT**

No.

Date:

M/s.

Sub: Certificate of commissioning of GIS

1. This is to certify that the GIS as detailed below has/have received in good condition along with all the standard and special accessories (subject to remarks in para no.2) and a set of spares in accordance with the contract /specifications. The same has been installed and commissioned.
 - a. Contract No.----- dated-----
 - b. Description of the GIS modules -----
 - c. Sr.Nos-----
 - d. Quantity -----
 - e. Bill of lading ----- dated-----
(for import contract)
 - f. name of the vessel/transporter-----
 - g. R/R No.-----
 - H. Name of the consignee -----
 - I. Date of commissioning and proving test-----
2. Details of accessories/spares not yet supplied and recoveries to be made on that account.

| <u>Sl.No</u> | <u>Description</u> | <u>Amount to be recovered</u> |
|--------------|--------------------|-------------------------------|
|--------------|--------------------|-------------------------------|

- 3. The proving test has been done to our entire satisfaction and operators have been trained to operate the GIS
- 4. The supplier has failed to fulfill his contractual obligations with regard to the following
 - A)
 - B)
 - C)
 - D)
- 5. The amount of recovery on account of non-supply of accessories and spares is given under para no.2
- 6. The amount of recovery on account of failure of the supplier to meet his contractual obligations is indicated in endorsement of the letter.

Signature -----

Name -----

Designation -----
With stamp

Explanatory notes for filling up the certificates

- a. he has adhered to the time schedule specified in the contract in dispatching the documents/drawings pursuant to technical specification.
- B. He has supervised the commissioning of the GIS in time i.e within the period specified in the contract from the date of intimation by the purchaser in respect of the installation of the plant.
- C. Training of personnel has been done by the supplier as specified in the contract.
- D. In the event of documents/drawings having not been supplied or installation and commissioning of the plant have been delayed on account of the supplier, the extent of delay should always be mentioned.

8(C) FROM OF COMPLETION CERTIFICATE

Date:

Name of contract,
Contract no-----

To,

(Name and address of the contractor)

Dear ladies and/or gentlemen,

Pursuant to relevant conditions of the contract entered into between yourselves and the employer dated-----relating to the (brief description of the facilities), we hereby notify you that the following part(s) of the facilities was (were) complete on the date specified below in accordance with the terms of the contract.

1. description of the facilities or part thereof-----
2. Date of completion: -----

This letter does not relieve you of your obligation to complete the execution of the facilities in accordance with the contract of your obligations during the defects liability period.

Very truly yours,

(Employers representative)

9. CHECK LIST FOR BID

Even though the bidding done on e-procurement flat form, the bidders shall invariably furnish the following information and records before opening of technical bid either personally or through courier or by post and the receipt of the same within the stipulated time shall be responsibility of the bidder and confirm furnishing of their enclosed checklist as under.

- | | | |
|----|---|--------|
| 1. | Whether original bid security either DD/BG is uploaded | Yes/no |
| 2. | Whether transaction fee to M/s C1 India is paid online | Yes/no |
| 3 | Guaranteed technical particulars enclosed | Yes/no |
| 4. | Whether financial turnover signed by auditors are furnished or not | Yes/no |
| 5. | Whether meeting qualifying requirements or not | Yes/no |
| 6. | Letter of authorization from manufacturer for the offered type of equipment | Yes/no |
| 7. | Whether sample of the offered type of cable is enclosed | Yes/no |

SIGNATURE OF THE BIDDER

WITH SEAL

10. SCHEDULE OF DEVIATION

TECHNICAL

| SR.NO | EQUIPMENT | ITEM NO | DEVIATIONS | REMARKS |
|-------|-----------|---------|------------|---------|
| | | | IF ANY | |

It is hereby confirmed that except for deviations mentioned above, the offer conforms to all the other features in technical specification in section-vii

Place : signature of the bidder

Date : name and address

Schedule of deviation

Commercial

| Sr.no | Terms and conditions item/clauses | Deviations if any | Remarks |
|-------|--------------------------------------|-------------------|---------|
| | | | |

Place : signature of the bidder

Date : name and address

11. Declaration form

Undertaking to be given by the company / partnership firm / contractor along with the tender

I, _____ representing the company / partnership firm / contractor responding to the bid invitation by the APTRANSCO / APEPDCL / APSPDCL / APNPDCL / APCPDCL vide specification no. ----- hereby sincerely and solemnly affirm and state as follows:

(Strike out that which is not applicable)

- (a) that myself or any of the representatives of my company / firm do not have any relatives as defined in the appended annexure iii in the APTRANSCO / DISCOMS.

Or

- (b) that the following officers / employees of THE APTRANSCO / DISCOM are related to me and to the representatives of my company / firm and their status in the APTRANSCO / DISCOMS is as under:

| Sl.no. | Name of the officer employee | Designation and place of working | APTRANSCO / DISCOM | Relationship |
|--------|------------------------------|----------------------------------|--------------------|--------------|
| 1. | | | | |
| 2. | | | | |
| 3. | | | | |
| 4. | | | | |
| 5. | | | | |
| 6. | | | | |

it is certified that the information furnished above is true to the best of my knowledge and belief. It is hereby undertaken that in the event of any of the above information found to be false or incorrect at the later dated the APTRANSCO / DISCOM is entitled to terminate the contract / agreement entered into besides recovering damages as may be found necessary, with due notice.

Signature of the authorised representative

Declaration to be given by the company / partnership firm / contractor at the time of entering into agreement with APTRANSCO / DISCOMS:

(Strike out that which is not applicable)

- (a) I declare that myself or any one of the representative of my company / firm do not have any relatives as defined in the appended annexure ii in the APTRANSCO / DISCOM.

Or

- (b) That the following officers / employees of the APTRANSCO / DISCOMS are related to me and to the representatives of my company / firm as mentioned hereunder:

| Sl.no. | Name of the officer employee | Designation and place of working | APTRANSCO / DISCOM | Relationship |
|--------|------------------------------|----------------------------------|--------------------|--------------|
| 1. | | | | |
| 2. | | | | |
| 3. | | | | |
| 4. | | | | |
| 5. | | | | |
| 6. | | | | |

it is certified that the information furnished above is true to the best of my knowledge and belief. It is hereby undertaken that in the event of any of the above information found to be false at the later dated the APTRANSCO / DISCOM is entitled to terminate the contract / agreement entered into besides recovering damages as may be found necessary, with due notice.

SIGNATURE OF THE AUTHORISED REPRESENTATIVE

LIST OF RELATIVES:

- | | |
|---------------------------------------|--|
| 1. Father | 14. Daughter's husband |
| 2. Mother (including step mother) | 15. Daughter's son |
| 3. Son (including step son) | 16. Daughter's son's wife |
| 4. Son's wife | 17. Daughter's daughter |
| 5. Daughter (including step daughter) | 18. Daughter's daughter's husband |
| 6. Father's father | 19. Brother (including step brother) |
| 7. Father's mother | 20. Brother's wife |
| 8. Mother's mother | 21. Sister (including step sister) |
| 9. Mother's father | 22. Sister's husband |
| 10. Son's son | 23. Son's wife's father |
| 11. Son's son's wife | 24. Son's wife's mother and their siblings |
| 12. Son's daughter | 25. Daughter's husband's father |
| 13. Son's daughter's husband | 26. Daughter's husband's mother |

FORM 12: : BANK ACCOUNT DETAILS FOR RTGS

1. Name of the bank :
2. Name of the branch :
3. Branch code :
4. city :
5. Account no. :
6. MICR no. :
7. IFSC no. :
8. Income tax pan number :
9. Date of vat registration:
10. Place of vat registration :

Signature of the Bidder

FORM: 13 :: BANKERS CERTIFICATE**TO WHOM SO EVER IT MAY CONCERN**

This is to certify that m/s.
_____, having their plant at _____ is our customers and have satisfactory record of transactions. They are having the credit limits of Rs. _____ lakhs in our bank.

PLACE:

DATE:

SIGNATURE OF THE MANAGER

NAME:

BANK ADDRESS AND SEAL.